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# ***JPRS Report***

# **Science & Technology**

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***Central Eurasia:  
Electronics & Electrical Engineering***

# Science & Technology

## Central Eurasia: Electronics & Electrical Engineering

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**Deforming Forces in the "Relyef" Electro-optic Light Modulator**

927K0349A Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 37 No 4, Jul-Aug 92 pp 276-283

[Article by Yu. P. Gushcho, V. M. Kartashov, Moscow Institute of Radio Engineering, Electronics and Automations; UDC 772.93.022]

[Abstract] The deforming forces (latent image), acting in the "Relyef" light modulator with an exponential build-up of uniformly distributed charge on the interface between the deformed layer (gel) and gas, were investigated previously. A non-uniform distribution of charge as well as the dynamics of its distribution with time is examined in this paper. Computation of the forces under these conditions uncovered four additional components, due to the surface charge nonuniformity. Two of them correspond to the principal process and are independent of the relief, but the other two are caused by interaction of the first spatial harmonics of the charge, the controlling voltage, and the relief geometry. Computations were made for two theoretically different modes of the light modulator operation under sufficiently intensive build-up of the charge on the interface. In the first mode, the constant spatial intensity component on the controlling surface is changing with time in pulses, but in the second mode this component is constant. Figures 4, references 3 Russian.

**A Complex Application of the Electronic Microscopy Methods for Diagnostics of Silver Halide Photographic Systems**

927K0349B Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 37 No 4, Jul-Aug 92 pp 308-317

[Article by V. P. Oleshko, M. V. Alfimov, Russian Academy of Sciences Institute of Chemical Physics; UDC 77.01:54]

[Abstract] Silver halide cinematographic and photographic materials consist of composite films with many layers, where different microcomponents are suspended in a polymer matrix. Feasibility is examined of applying electron-microscopy methods and image analysis for studying the silver halide photographic materials and their components. An algorithm is developed and experimentally substantiated for a complex application of the electron microscopy methods in diagnostics of the photographic systems. Data were obtained and systemized on the world-wide trends in application of the electron microscopy for analysis of the photographic materials. Figures 2, tables 2.

**On the Registration Mechanism of Electric Discharges in Silver Halide Emulsion**

927K0349C Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 37 No 4, Jul-Aug 92 pp 323-326

[Article by A. L. Kartuzhanskiy, L. K. Kudryashova, V. A. Reznikov, Soviet Trading Institute in Leningrad; UDC 53.087.5:621.3.015.533]

[Abstract] Local blackening is frequently observed in silver halide emulsion layers after they had been developed because of the generation of streamer electric discharges. As a part of a study on modeling the centers of AgHal-microcrystal's sensitivity by superior epitaxy, photographic materials were prepared where the microcrystals were not superior, but carried superior epitaxy on their surface. The materials were made of the MZ-3 film with regular microcrystals. For comparison, the original MZ-3 film was also used. Triboelectric discharges were observed in the developed films under uncontrolled conditions. The regular AgBr films produced Lichtenberg figures, but the films with superior-epitaxy microcrystals had strips or stretched spots. The density of the spots diminished from the center to the periphery. The reason for the significant difference between the two pictures was investigated and it was concluded that the main difference in the type of blackening lies not in the number of microcrystals participating in the streamer registration, but is related to the selection of the path of the charge propagation. Figure 2, references 7: 5 Russian, 2 Western.

**Calculation of Indicator Visibility**

927K0348A Moscow SVETOTEKHNIKA in Russian No 6, Jun 92 (manuscript received 29 Nov 91, signed to press 9 Mar 92) pp 1-3

[Article by A.A. Vaskovskiy, candidate of technical sciences, T.S. Ziyenko, engineer, V.A. Latyshev, engineer, and S.S. Romanov, candidate of technical sciences, Moscow Institute of Power Engineering and All-Union Institute of Illumination Engineering imeni S.I. Vavilov; UDC 621.383.932:612.843.36]

[Abstract] Visibility being defined as the ratio of actual contrast  $C$  to threshold contrast ( $P=0.5$  probability of recognition), an iteration algorithm is constructed for computer-aided calculating the visibility of indicators. It is based on the conventional expression for the contrast  $C = (L_i - L_b) / L_b$  ( $L_i$  - indicator illuminance,  $L_b$  - background illuminance). The input data are: calculated or measured illuminance distribution  $L(x,y)$  over entire image and background illuminance  $L_b$ . First are calculated the pertinent illumination characteristics, including the contrast distribution  $K_i(x,y)$  in  $i$ -th image on each iteration step. The eye's visual perception is described in terms of equivalent noise power. When the parameters of equivalent noise power  $A, p, q$  (SVETOTEKHNIKA No 11,

1990; OPTIKO-MEKHANICHESKAYA PROMY-SHLENNOST No 9, 1987) are known, then the signal-to-noise ratios in images and their respective differences are calculated immediately. When these parameters are not known, then first they must first be calculated from the results of a few additional character recognition tests. The signal-to-noise ratios are normalized to the actual contrast squared so that the image recognition probability becomes an explicit function of that contrast. The next step is calculating the threshold contrast and then finally the indicator visibility. This algorithm was tested on character-synthesizing indicators ALS338A, ELS338B, and IV-22. For these devices were first evaluated the dependence of the actual contrast on the spread of indicator illuminance  $L$  in terms of the  $L_{\max}/L_{\min}$  ratio, on the background luminance, and on the character height measured in angular minutes ( $10', 30'$ ). Their visibility was then calculated as a function of the observation angle over the  $0-90^\circ$  range and as a function of the illumination level over the  $100-10,000$  lx range. Figures 5; references 7.

#### Multilayer Interferences Coatings in Discharge Lamps

927K0348B Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 (manuscript received 19 Dec 91, signed to press 27 Feb 92) pp 3-5

[Article by V.B. Gritskovich, engineer, and A.S. Ivantsev, candidate of physical and mathematical sciences, All-Union Institute of Light Sources imeni A.N. Lodygin; UDC (628.9.621.327):535.2]

[Abstract] The design of multilayer interference coatings for mercury lamps is outlined, their purpose being to increase the luminous output of these lamps and to correct their emission spectrum. The first step in the design procedure is analysis: determining the spectral characteristic of either the reflection coefficient or the transmission coefficient of such a coating which will match the given required spectral emission characteristic of the lamp, the emission characteristic of a plain mercury lamp being always known. Two equations, one for the spectral emission characteristic of a plain lamp and one for its required spectral characteristic attainable by coating the lamp, are solved simultaneously by an either analytical or graphical method. The second step of the design procedure is synthesis: determining the number of layers, also the thickness and the refractive index (material) of each, which will make a coating with spectral characteristics approaching the ones required of it. An effort is made here to minimize the number of layers and to select most easily processable materials. The procedure is demonstrated on coatings for ozone-free superhigh-pressure xenon lamps and high-pressure high-intensity sodium lamps. For each was selected a triple-layer  $\text{TiO}_2\text{-SiO}_2\text{-TiO}_2$  coating,  $\text{TiO}_2$  having a high refractive index and  $\text{SiO}_2$  having a low refractive index. Such coatings were deposited on the bulbs by an ecologically clean chemical process at  $20^\circ\text{C}$  room temperature in air with 50-60 percent relative humidity. The two

$\text{TiO}_2$  films were deposited from a solution in 96 percent pure ethanol and the  $\text{SiO}_2$  were deposited from a solution in 99 percent pure ethanol. After deposition the  $\text{TiO}_2$  films were annealed at  $550^\circ\text{C}$  in air for 15 minutes and the  $\text{SiO}_2$  films were annealed at  $450^\circ\text{C}$  in air for 10 minutes. The structure of all films was examined for crystalline content in a DRON-1 x-ray diffractometer with filtered  $\text{CuK}_\alpha$ -radiation, the results indicating that  $\text{TiO}_2$  films annealed at  $550^\circ\text{C}$  contained traces of rutile in an amorphous matrix (those annealed at lower temperatures contained a small fraction of anatase with a lower refractive index in an amorphous matrix) and that  $\text{SiO}_2$  films annealed at any temperature within the  $300-500^\circ\text{C}$  range were entirely amorphous. Figures 4; references 10.

#### Methods of Adjusting Ballast Chokes for Discharge Lamps

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No 6, Jun 92 (manuscript received 29 Apr 91, signed to press 9 Mar 92) pp 5-7

[Article by V.F. Boyko, engineer, I.V. Dzyubin, engineer, and N.G. Tarsenko, candidate of technical sciences, All-Union Design Engineering Institute of Lighting Technology, Ternopol; UDC 621.318.43(088.8)]

[Abstract] Four methods of adjusting ballast chokes in production for discharge lamps to a given current level are available, all leading to adjustment of the effective magnetic permeability by insertion of continuous non-magnetic spacers into the choke core so as to make variance of the magnetic permeability of its material and thus the effect of that variance on the impedance of the choke much less significant. Compensating the variance of the magnetic permeability is much simpler and more practical than adjusting on the assembly line either the number of turns in the choke coil or the core length and cross-sectional area, on all of which the choke impedance also depends. The first method is to insert one nonmagnetic shim into the air gap in the core, its thickness being selected so as to make it equivalent to the appropriate change of the number of turns in coil and thus proportional to its change of inductance calibrated in units of distance. The second method is to insert two magnetic shims of a fixed thickness each. The thinner first shim extends over the entire core length and decreases the current in the choke coil to some magnitude below the nominal one. The thicker second one on top extends only over a part of the core so that the width of the nonmagnetic gap will have increased stepwise, the length of this shim being determined semiempirically so that the current in the choke coil will be restored to its nominal magnitude with a 2.5 percent tolerance. The length of the second shim will, therefore, vary from choke to choke. The third method is to form an air gap of fixed width by means of stack of specially punched T-form keeper laminations. The fourth method is to split the core into two stacks by inserting a lamination of a nonmagnetic and mechanically soft material such as copper, aluminum, or lead. The thickness of this lamination can be



regulated so as to ensure that a current of nominal magnitude in the choke coil. This can be achieved by any of four known techniques: 1) smoothly pressing together the two stacks with a constant force; 2) rolling both stacks lengthwise and thus compressing them with a constant force; 3) locally striking the base of the T-stack inserted into the  $\Pi$ -stack with a mallet driven by an electromagnet and thus causing displacement of the laminations; 4) smooth transverse compression of T and  $\Pi$  stacks by rolling in discrete repetitive cycles for rough adjustment and use of a wedge for fine adjustment. Adjustments made by the fourth method using the last technique is most precise and stable, according to the results of tests performed at the "Vatra" plant. Figures 3; references 7.

#### Switching-On DRI175 and DRI400 Metal-Halide Lamps Without Igniter

927K0348E Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 (manuscript received 21 Nov 91, signed to press 22 Jan 92) pp 7-9

[Article by S.A. Obchukova, candidate of technical sciences, Moscow Institute of Agricultural Equipment Engineers imeni V.P. Goryachkin; UDC 621.327.534:546.13]

[Abstract] The feasibility of starting DRI400 and DRI175 low-power metal-halide lamps operating with a binary halide mixture  $\text{NaI} + \text{ScI}_3$  and four electrodes (hollow cathode) by applying the 220 V line voltage directly without an igniter is considered, the ignition voltage for these lamps having already been appreciably lowered by use of a hollow rather than solid cathode and needing to be further minimized by optimization of the cathode design. A study of this problem was made by the "Lisma" Union of Consumer Societies, using experimental lamps with various hollow cathodes and filled with a mixture of Hg vapor + Ar. The results have been analyzed by referring to the already known ignition characteristics of DRL lamps, assuming that the laws of similarity remain valid and considering that the initial pressure in a lamp is determined by the Ar-Hg mixture alone. Ten different cathode designs aiming to maximize the "hollow-cathode effect" were evaluated by testing them in lamps, the number of lamps with each kind of cathode to be tested having been determined in accordance with the chi-square criterion for a 0.95 confidence level. Only bifilar oppositely wound cathodes and coaxially wound cathodes consisting of two coaxial cylindrical helices (smaller helix mounted on core and inserted inside larger helix) were found to be acceptable for use without igniter, based on an average ignition voltage of 170 V after a 2 minute warm-up period or 160 V after a 1 h warm-up period and on at least 10,000 h average life under a 220 V-50 Hz voltage or with a 1000 Hz power supply. The advantages of bifilar cathodes are their greater configuration flexibility and a simpler manufacturing process. The advantages of coaxial cathodes are reliable mounting and stable discharge after removal of core. Figures 3; tables 2; references 6.

#### Selection of Radiator Operating Mode for Photohardening Optical-Fiber Coatings

927K0348E Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 (manuscript received 12 Nov 91, signed to press 22 Jan 92) pp 13-15

[Article by S.G. Ashurkov, candidate of technical sciences, A.A. Makovetskiy, candidate of physical and mathematical sciences, and Yu.R. Tsyryn, engineer, All-Union Institute of Illumination Engineering imeni S.I. Vavilov, Institute of Radio Engineering and Electronics at Russian Academy of Sciences, and All-Union Institute of Cable Industry; UDC (621.327.5.535:535-31):681.7.068]

[Abstract] Photohardening of protective optical-fiber coatings by radiation treatment with high-pressure ultraviolet mercury lamps is considered, pulsed operation of such radiator lamps appearing to be more energy efficient than the apparently simpler continuous operation of lamps with light emitting additives injected into the mercury vapor. An experimental study of this process was made, layers of De Solite 950-132 urethane acrylic films (De Soto Co., USA) having been treated with a model ultraviolet radiator using a DRT400 lamp. For the irradiation study were prepared 30  $\mu\text{m}$ , 85  $\mu\text{m}$ , and 130  $\mu\text{m}$  thick layers on 1.6 mm thick and 40 x 45 mm<sup>2</sup> large photographic-grade glass plates. Irradiation tests were performed on them using a DRT400 lamp, with a gas stream injected into the 6 mm wide and 7 mm high irradiation zone: in one series of tests with a nitrogen stream (inert medium) injected through a special nozzle connected to the outlet hose of the nitrogen tank and in one series of tests with an air stream injected either through a tube made of quartz glass (as one used with conventional ultraviolet lamps) or directly without it. The nitrogen flow maintained at a constant rate sufficiently low to avoid wrinkling of the specimens. Tests were performed with the lamp bare and with the lamp inside a 140 mm long reflector in the shape of an elliptical cylinder made of aluminum sheet. The lamp emitted flashes of 1.0 ms or 0.42-0.44 ms duration (at half-amplitude level) with a repetition rate of 100 Hz, their average power being equivalent to 400 W in the continuous mode of operation. On the basis of the test data has been evaluated the dependence of the gel fraction in a coating on the length of exposure time, this fraction typically leveling at about 90 percent after a total exposure time of 0.7 s. Figures 2; tables 2; references 9.

#### Estimating Emittance of Cathodes in Fluorescent Lamps

927K0348F Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 (manuscript received 18 Jun 92, signed to press 29 Feb 92) p 16

[Article by L.D. Gurakova, engineer, L.I. Zverin, candidate of technical sciences, K.K. Namitokov, doctor of



technical sciences, professor, and Ye.V. Shepilko, candidate of technical sciences, Kharkov Institute of Municipal Economy Engineers; Scientific and Technical Center "Svet"(Light); UDC 621.327.534.15.032.21]

[Abstract] A simple method of estimating the emittance of oxide-coated cathodes in fluorescent lamps during factory inspection is proposed, a "yes" or "no" reading of the instrument indicating whether or not the emittance meets specifications applicable to a given production lot. The method is based on the fact that the temperature at which the emitter current will reach the level necessary for negative glow to begin and the corresponding heat-up time both depend on the work function for the cathode material, a higher work function requiring a higher temperature. The method requires that cathodes be heated by a power supply operating as a current rather than voltage source. The instrument which records the beginning of glow therefore includes a current source and a current stabilizer, also a timer with a decoder indicating the instant at which the emitter current has reached that necessary level, a photocell followed by an operational amplifier, and a comparator with the necessary sensitivity. A synchronizer generates the pulse which stops the timer as glow begins. The heat-up time is recorded, accurately within 0.01 s, with pulses of 0.01 s duration from a clock generator and of 0.1 s and 1 s duration from the decoder. The relation between cathode emittance and cathode heat-up time has been established experimentally, eight cathodes of 40 W lamps produced at the Poltava plant having been selected for measurement of their thermionic emission current by the standard radio noise method. Their thermionic emission current and their heat-up time with a 0.5 A current were found to vary over the 135-170 mA range and the 1.25-1.40 s range respectively. While this method of measuring the thermionic emission current is quite inaccurate with an up to 15 percent estimated error, a subsequent experiment performed with 24 cathodes and a statistical analysis of the results have yielded a  $P=0.95$  probability of a 2.1 s mean heat-up time within a  $\pm 0.3$  s confidence interval. Figures 1; references 3.

#### Use of Lasers in Theaters and Show Places

927K0348G Moscow SVETOTEKHNIKA in Russian  
No 6, Jun 92 p 19

[Article by G.I. Ashkenazi, engineer, chairperson, "Scenic and Studio Lighting" Committee of Illumination Engineering Society; UDC (621.375.826); 791.4(083.74)]

[Abstract] Considering that radiation from lasers of various types and strengths now used for special light effects in theaters and many other entertainment establishments may be harmful, a memorandum concerning this problem was on 8 April 1985 sent by the Moscow Municipal Health and Epidemiology Center to managers of Moscow's entertainment establishments and to physicians in the Moscow district hygiene maintenance centers. This memorandum under the title "Sanitary and

Hygienic Requirements for Use of Lasers in Entertainment", stated in paragraph 1.2 that its purpose is to prevent harmful effects of laser radiation on Moscow's population including children. The memorandum contained eight chapters: "General Premises", "Preventive Measures", "Requirements for Installation of Lasers", "Requirements for Setting Up Light Effects", "Order in Issuance of Permits for Use of Lasers", "Responsibility", "Inspection", "Conclusions". On the basis of this memorandum the 1986 All-Union Standard OST43-12.2.001-86 was developed. This standard was in June 1988 reviewed by members of the scientific-technical illumination engineering section reporting to Moscow's regional board of the All-Union Power and Electrical Engineers Society. It was then submitted, with several revisions, to the USSR Ministry of Culture and standard-coordinating organizations and temporarily suspended. After the USSR Ministry of Culture on 9 December 1988 revoked Standard 455, the All-Union Scientific Research and Design Engineering Institute of Culture proposed to develop in 1990 a new standard based on the OST43-12.2.001-86 and including safety rules. This has not been done so far and, therefore, it is necessary that the RSFSR Ministry of Health and Culture jointly with appropriate regional institutions produce the document and submit it to the Illumination Engineering Society for validation.

#### Journal SVETOTEKHNIKA Important Step in Promoting International Cooperation of Specialists

927K0347A Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 92 p 1

[Article by Yu.B. Aizenberg, chief editor of SVETOTEKHNIKA]

[Abstract] The new editorial council of this SVETOTEKHNIKA has seven members from foreign countries, including Prof H.W. Bodmann (Institute of Illumination Engineering at Karlsruhe University, Germany), Dr Z. Krasko (Sylvania Co., Denver, Colorado/USA), and Dr R. MacMahon (Solar Energy Center, Florida/USA). The journal will be bringing articles by foreign specialists in the field of illumination. The journal will contribute to exchange and dissemination of information about developments worldwide and about activities of the ICI. The journal will facilitate cross-referencing with and subscription to foreign journals. An important factor in the realization of these aims will be establishments and development of personal as well as business relations between the journal's publishing staff and the foreign contributors.

#### Development of Discharge Lamps With Ecologically Clean Buffer Gas Filler

927K0347B Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 92 (manuscript received 10 Dec 91, signed to press 3 Feb 92) pp 2-3

[Article by G.S. Sarychev, doctor of technical sciences, All-Union Institute of Illumination Engineering imeni S.I. Vavilov; UDC 621.327.577.4]

[Abstract] Replacement of mercury vapor as filler in discharge lamps with an ecological clean buffer gas one is considered, the problem being to retain or at least approach the favorable characteristics of the former (small heat loss, low pressure in cold state, large potential gradient in positive column of discharge). This problem has already been analyzed in the development of metal-halide lamps and xenon lamps, but not from the ecological standpoint. It is analyzed here on the basis of four criteria of adequacy of a "clean" substitute for mercury vapor in terms of lamp performance: 1) energy balance (electrical power of the positive column equal to integral luminous flux from additive + integral luminous flux from buffer gas + heat loss in positive column), 2) luminous efficiency (integral luminous flux + heat loss), 3) effective excitation potential (3-4 eV), 4) optimum filler gas pressure for maximum potential gradient in positive column, i.e., operating lamp voltage in accordance with Ohm's law ( $E = j/\sigma$ ,  $j$  - current density in positive column,  $\sigma$  conductivity of discharge plasma). Inasmuch as that a high-temperature buffer gas would be most advantageous here, extraction of light at resonance wavelengths of the emission lines of halide ions being facilitated by absence of ions around the periphery of discharge, xenon is shown to be an excellent alternative to a mercury vapor as buffer gas in combination with thallium iodide as additive. The author thanks G.N. Gavrilkina for assistance in preparation of this article. Figures 2; references 6.

#### Computer-Aided Design of Specular Reflectors

927K0347C Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 92 (manuscript received 2 Jul 90, signed to press 22 Nov 91) pp 3-4

[Article by I.N. Anisimov, engineer, and V.I. Rychkov, candidate of technical sciences, Moscow Institute of Power Engineering; UDC 628.94.001.24]

[Abstract] The design of specular reflectors of light from sources with given luminance characteristics can be automated when the path of axial rays is described in terms of the functional relation between their reflection angle  $\alpha_0$  and incidence angle  $\varphi$  with the optical axis so that the inverse problem as well as the forward problem becomes solvable by an iteration scheme. One such scheme utilizes the dependence of the reflector candlepower curve on the reflection angle  $\alpha_0$  and also the equation of luminous flux balance, according to which the reflector candlepower  $I$  as a function of the reflection angle  $\alpha$  is inversely proportional to the derivative of that angle with respect to the incidence angle  $\varphi$ . With the ranges of all three variables  $\alpha_0$ ,  $\varphi$ , and  $I$  normalized to the  $[0, 1]$  interval (0 - initial value, 1 - final value), a recurrence relation is formulated for computer-aided calculation of the reflector candlepower curve on a finite  $I$ ,  $\alpha$  grid and thus for a numerical solution of the design problem, i.e., solution of the nonlinear integral equation of the first kind in the compact operator form  $Ay = f$  ( $A$  - nonlinear integral operator, function  $y$  in set  $Y$  characterizing the reflector surface geometry, function  $f$  in set  $F$

characterizing the required luminous flux distribution over the reflector surface). Inasmuch as at some point the iteration process becomes divergent, the problem being an ill-conditioned one, a criterion needs to be established for termination of iteration process: step following  $m$ -th step after which the functional  $\|Ay_m - f\|_F$  has ceased to decrease. The input data for the design are the luminance characteristics and the geometrical characteristics of the light source, initial and final values of  $\alpha_0$  angle characterizing reflection of axial rays, initial and final values of  $\alpha$  angles characterizing reflection of other rays, initial radius vector  $r_0$ , specular reflection coefficient  $\rho$ , and required reflector candlepower. The integral operator  $A$  is given in the form based on some numerical method of solution of the forward problem (to determine luminous flux distribution over reflector surface of given geometry). This iteration scheme was tested on Standard System YeS-1045 computer for a reflector of light from a light source in the form of a sphere 40 mm in diameter with a uniform luminance distribution over its surface. Figures 1; references 3.

#### Light Signaling System for Helicopter Landing on Floating Drill Platforms

927K0347D Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 92 (manuscript received 14 Mar 91, signed to press 22 Jan 92) pp 8-11

[Article by Yu.G. Basov, doctor of technical sciences, Ye.Yu. Bibayev, engineer, and Ye.V. Nasonov, engineer, Special Engineering Design Office for Lighting and Light Signaling Devices, Moscow; UDC 628.975:[629.735.45: 629.735.55]

[Abstract] A light control-signaling system "Akvarium" has been developed in the USSR for safe helicopter take-off from and landing on ships or drill platforms, three similar special-purpose systems being already in operation here and seven types of such an apparatus being used abroad. The design of this new system complies with requirements specified in the USSR Maritime Register and by the ICAO. The system includes 1 or 2 identification beacons, 8 landing beacons, up to 28 marker beacons, 6 floodlight projectors for lighting up the landing pad, 1 or 2 wind direction indicators, up to 10 plain hazard beacons and up to 8 explosion-proof hazard beacons, 2 floodlight projectors for lighting up the water surface, one indicator of deck position during rocking, and a "DO NOT ENTER" sign. The identification beacon is the first lighting device a helicopter encounters prior to landing, this beacon enabling the pilot to make visual contact with the landing pad from a distance of a several kilometers by transmitting an H-form sign in the Morse code at a rate of 20-30 signs per minute. This beacon has two specular aluminum reflectors: a paraboloidal lower one and a conical upper one. The glide slope beacon for approach control is one of the most important components of this system. It has a 24 V-100 W halogen-cycle incandescent lamp, an ellipsoidal reflector, a compound light filter with a narrow strip of green glass and semicircular disk of red glass, and a

planocovex lens with a 246 mm focal length. Depending on the weather conditions and on the time of day or night, its lamp can be switched to any of three brightness positions: full - 30 percent - 10 percent. The landing pad is identified by green light from pocket-type landing beacons. The indicator of deck position consists of two displays, one for digital roll indication in 0-10° and one for digital trim indication in 0-4°. The characters appear in the form of appropriate combinations of straight horizontal and vertical segments, each segment lighted by two KGM12 V-10 W metal-halide lamps. Two adjacent similarly lighted but green arrows on each display indicate the ship's left side and right side respectively. The indicator set is connected into an electric circuit through a power supply and a decoder. It is mounted in a position ensuring its visibility at a distance of 100 m from the landing pad. The indicator panel is controlled by a gyro system on board, the control panel drawing power from a 3-phase 220 V-50 Hz shipboard alternator. In the development of this light signaling system participated L.P. Averina, V.T. Voronina, L.B. Grebeshkova, Ye.M. Kamrotova, R.I. Makarova, S.V. Mormol, N.P. Podporina, B.V. Skvortsov, O.S. Solovyeva, and L.M. Shishkina. Figures 8; references 5.

#### **Skylight Distribution Inside Building as Optical Image of Surrounding**

927K0347E Moscow SVETOTEKHNIKA in Russian No 4, Apr 92 (manuscript received 19 Jun 91, signed to press 20 Feb 92) pp 11-14

[Article by D.V. Bakharev, candidate of technical sciences, Nizhegorodskiy Institute of Construction Engineering; UDC 628.921.928]

[Abstract] The coefficient of natural illuminance inside a building was calculated by treating the skylight distribution inside the building as the image of the surrounding: fuzzy images of the sky, of the earth (street pavement), and of the facade across the street. The given building was assumed to stand alongside an infinitely long street of finite width. The width of the street, being a major influencing factor, was varied over a wide range. Calculations were made on a computer using the SCONCH-LARA87-CONCHS-ERDS-FASS-LARIS1 set of programs. Not only the resultant coefficient of natural illuminance but also both its two components representing directly incident light (from sky) and reflected (by earth or street pavement and by facade across the street) light respectively. The results have been plotted in the form of isolines on a rectangular grid depicting the distribution of the resultant coefficient and of its two components over both front and back walls, over one of the two identically illuminated side walls, over the floor, and over the ceiling. On the basis of these data have then been evaluated mean and minimum values of that coefficient, also its dependence on the width of the street and on the ratio of its reflection component to its direct-incidence component. Figures 5; references 5.

#### **Effect of Electric Heating on Fragility of Tungsten Wire**

927K0347F Moscow SVETOTEKHNIKA in Russian No 4, Apr 92 (manuscript received 26 Apr 90, signed to press 22 Jan 92) pp 16-17

[Article by B.V. Pastuman, candidate of technical sciences, All-Union Institute of Light Sources imeni A.N. Lodygin; UDC 621.326.032.32.032.9]

[Abstract] Inasmuch as heating a tungsten wire while it is being formed into a coil increases its plasticity and thus makes it not only less fragile but also more consistently contiguous to the winding arbor, the author has proposed contactless electric heating of such a lamp wire. The process and its effect on the mechanical strength of tungsten wire are now analyzed by Wald's method of calculating, on the basis of test data and in accordance with queuing theory, the probability of fracture of heated wires and of unheated wires during winding. Such tests were performed at the three lamp manufacturing plants in Poltava, Kalashnikov, and Ufa. The results of this analysis indicate that heating a tungsten wire while it is being wound at high speed (18,000 rpm) will decrease its fragility by a factor ranging from 2.7 to 14, but a statistical analysis of the data indicates that this hypothesis is based on an insufficient number of such tests. Different tests were performed at the Saran plant. There wires from the same lot were wound into a coil of the same length twice: first without being heated and then while being heated. The drawback of these tests was that, owing to a possible variation of properties along the wire, its fragility could and in some case did increase despite the heat treatment. Nevertheless, disregarding the insufficiency of available fracture test data, the criteria for a beneficial effect of heat treatment during winding of tungsten wire have been generally satisfied. Tables 2; references 5.

#### **Ecological Problems and Current Trends in Development of Fluorescent Lamps**

9927K0347G Moscow SVETOTEKHNIKA in Russian No 4, Apr 92 (manuscript received 19 Dec 91, signed to press 22 Jan 92) pp 18-19

[Article by R.F. Kirsanov, engineer, and M.A. Malkov, candidate of physical and mathematical sciences, All-Union Institute of Light Sources imeni A.N. Lodygin; UDC (628.94:621.327.534.15):577.4]

[Abstract] An analysis of latest trends in development and use of low-pressure fluorescent and other mercury lamps from the ecological standpoint brings into question the advantages of such lamps, not only because of the rapid deterioration of their active materials with attendant degradation of their performance and shortening of their service life but also because of their toxicity owing in large measure to the mercury vapor. A review of the design criteria is required including a lower optimum concentration of mercury vapor, smaller sizes and higher energy efficiency, and better color within a



better radiation spectrum. From the application standpoint these lamps are classified into four groups: 1) for area lighting, 2) for local lighting, 3) for irradiation, 4) for decoration and advertisement. Ecological factors will greatly but differently influence the redesign of lamps in each group and the new respective manufacturing technologies. Lamps for area lighting are expected to remain in use for another 10-15 years, while the assortment of lamps for local lighting will most likely be much enlarged.

#### Sensitivity of Optical Radiation Receiver

927K0347H Moscow SVETOTEKHNIKA in Russian  
No 4, Apr 92 (manuscript received 25 Jan 91, signed to press 6 Dec 91) pp 19-20

[Article by A.B. Bekbayev, doctor of technical sciences, professor, A.Ye. Vdovina, candidate of technical sciences, and A.S. Urtembayev, candidate of technical sciences, Alma-Ata Institute of Technology and Kazakh Institute of Agriculture; UDC 621.84]

[Abstract] Two definitions of "sensitivity of optical detector" are considered as proper from the standpoint of clarity and consistency. It can be and is defined either as the ratio of an output quantity (current or voltage) to an input quantity (radiation or luminous flux) and thus as the response-to-stimulus ratio. It can also be defined as "efficiency", the detector then being regarded as a converter of radiant to electric energy. Other definitions qualifying the detector sensitivity as "spectral" when referring to monochromatic incident radiation of "integral" when referring to polychromatic incident radiation may lead to ambiguity, unless the concept of an "effective flux" is introduced. In this case the question arises as to whether "effective flux" refers to flux absorbed by the detector or flux emitted by the source and whether it is oddly enough measured in amperes or in volts. Expressing the detector sensitivity in lumens per watt is altogether improper, inasmuch as a radiation detector is not a radiation source. References 2.

#### Fluorescence of Light-Scattering Optical Glasses

927K0328A Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 (manuscript received 31 Jan 91, signed to press 8 Jul 91) pp 2-4

[Article by A.V. Novitskiy, engineer, All-Union Institute of Optophysical Measurements, Moscow; UDC 535.372:681.785.423]

[Abstract] An experimental study of special opal glasses for reflector-spectrophotometer testing was made concerning their fluorescence induced by impurities ( $F^-$  ions,  $ZnO$ ,  $PbO$ ,  $Pb_2O_3$ ) added to make them milky white but limiting their usefulness in operation with ultraviolet light. The glasses for this study were grades MS-12/13/19/23 scattering diffusely transmitted light and grades MS-20, ONS-1/2/3/4 diffusely reflecting incident light. Plate specimens of all glasses were tested in a

Hitachi 60S fluorimeter with two monochromators, an illuminator and an analyzer, their axes being in quadrature and the glass plate to be tested in front of the analyzer. A plane aluminum mirror rotatable about its normal axis in a  $45^\circ$  position was placed in the test cell before the glass specimen so as to reflect onto it the light beam from the illuminator. The plate of a light-scattering glass was placed perpendicularly to the incident light from the mirror and to the analyzer axis. The plate of a diffusely reflecting glass was tilted from a  $45^\circ/45^\circ$  position to make a  $50^\circ$  angle with the incident light beam and a  $40^\circ$  angle with the analyzer axis, to prevent Fresnel reflection of incident light by the polished glass surface. Tests were performed with ultraviolet excitation of shorter than  $340\text{ }\mu\text{m}$  wavelengths, for a determination of the short-wave limit for each glass. Fluorescence of the diffusely reflecting MS-20 glass was found to occur upon excitation at wavelengths shorter than  $320\text{ }\mu\text{m}$ . This glass was found to re-emit almost only  $320\text{--}520\text{ }\mu\text{m}$  light when excited with ultraviolet light of wavelengths shorter than  $260\text{ }\mu\text{m}$ , most intense being consistently the  $380\text{ }\mu\text{m}$  light as the excitation wavelength was varied over the  $300\text{--}220\text{ }\mu\text{m}$  range. For the light-scattering glasses the short-wave limit was defined by the criterion of a 1/10 ratio of total radiant luminescence flux (with  $520\text{ }\mu\text{m}$  as the long-wave edge) to transmitted radiant flux at the excitation wavelength. The thus arbitrarily defined short-wave limit (longer than the short-wave edge) was found to shift to longer waves for glasses with higher optical density and correspondingly smaller transmission coefficient  $T$ , from  $300\text{ }\mu\text{m}$  for MS-19 glass ( $T=0.912$ ) to  $330\text{ }\mu\text{m}$  for MS-12 glass ( $T=0.395$ ). Figures 3; tables 1; references 3.

#### Coalescence of DRT1400 Metal-Halide Lamps in Horizontal and Vertical Positions

927K0328B Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 (manuscript received 26 Feb 90, signed to press 8 Jul 91) pp 4-7

[Article by A.G. Galstyan, Industrial Association "Luys (Light)", Yerevan; UDC 621.327.534.2]

[Abstract] An experimental study of DRT1400 metal (Ga)-halide lamps was made with the bulbs in horizontal position and in vertical position, of specific interest being their coalescence during the transient period after discharge has begun. During this period the discharge was photographed every 5 s, while both voltage and current were measured for a determination of the electrical resistance of the lamp and the electrical conductivity of the discharge column. The longitudinal temperature profile of the bulb was determined with the aid of a Chromel-Alumel thermocouple probe, its junction being covered with white chalk powder so as to shield it from background radiation. The luminous flux was measured with a bare selenium photocell through a neutral attenuating light filter. The photographs of lamps in horizontal position revealed a lower stability of discharge, an instability center in the form of neck migrating in up to 80 s from one electrode to the other at



a velocity of 1-3 mm/sec. An experimental metal (In)-halide lamp (4 kPa Ar, 50 mg Hg, 4 mg PbI<sub>2</sub>, 1 mg In) was built and also tested for performance in both positions. Here the discharge pattern was similar, but the transient period of coalescence was up to two times longer owing to a slower than 1 mm/s movement of the instability center in the more sluggish indium plasma. The photographs of lamps in vertical position revealed strong erosion of the current leads made of molybdenum foil by iodine vapor and attendant transfer of this metal to hotter sites, evidently as a consequence of their temperature being lower than the temperature of optimum molybdenum evaporation rate. This detrimental feature has been abated and the life of lamps in this position thus lengthened from not more than 100 h to at least 1000 h by warming up the colder current lead at the lower end of the lamp with a heater spiral and not by increasing the impurity concentration, which would have changed the discharge balance and decreased the luminous flux. Figures 5; references 2.

#### Effect of Reflection by Earth on Illuminance of Rooms

927K0328C Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 (manuscript received 24 Apr 91, signed to press 26 Apr 91) pp 8-9

[Article by D.V. Bakharev, candidate of technical sciences, and L.N. Orlova, candidate of technical sciences, Nizhegorodskiy Institute of Construction Engineers; UDC 628.921.926]

[Abstract] The effects of skylight reflection by the earth (street pavement) and of the shadow cast by buildings across on the illuminance of rooms on any floor of a house were evaluated numerically in terms of the coefficient of natural illuminance or, more precisely, its direct-incidence component. The calculations were made for an infinitely long street whose width was varied over a wide range. They were made on a computer using the ERDS program written in FORTRAN and analogous to the FASS program in the SCONCH-LARA87-ERDS-LARIS1 complex, the distribution of that coefficient then plotted from the data in the form of isolines on a grid representing the floor, the ceiling, the front wall (with window) and the other three walls. The grid was so designed that the coefficient of natural illuminance for each rectangular grid element depended neither on the shape and the size of a grid segment but only on its brightness. The results of these calculations and of those based on the authors' multiparametric model accounting for multiple reflection of skylight should be useful for development of engineering formulas for the coefficient of natural illuminance needed for the layout of urban buildings. Figures 3; references 3.

#### Design of Optical Systems for Luminaires Used in Medical Practice

927K0328D Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 (manuscript received 7 May 92, signed to press 2 Sep 91) pp 10-13

[Article by W. Dybczynski, Bialystok Polytechnic Institute (Poland); UDC 628.94:628976:6.001.63]

[Abstract] In medical practice are now commonly used three types of luminaires, all with a halogen-cycle incandescent lamp and a "cold" reflector but different optical systems depending on the required radiation spectrum. The first optical system consists of a "cold" ellipsoidal reflector shell with its inside focus at the center of the light source and its outside focus at the center of a hole in a wider auxiliary concave spherical reflector-concentrator, this reflector being followed by an absorption or interference filter which raises the color temperature. The second optical system consists of a "cold" paraboloidal reflector shell with its focus at the center of the light source inside, a plane interference filter tilted at a 45° to the reflector axis, and a plane scatterer making a 45° angle with the mirror (thus parallel to the reflector axis). The mirror corrects the color temperature and reflects the incident parallel light beam at a 90° angle onto the scatterer, which diverges the light beam so that the entire object surface will be covered. The infrared light content is higher in the second optical system. The third optical system, most widely used in Poland, consists of a "cold" ellipsoidal reflector shell with its inside focus also at the center of the light source but its outside focus telescoped by a plane opaque mirror and a plane scatterer farther under that mirror onto the center of the light spot on the object surface. Extended variants of these luminaires are shadowless luminaires with 3-10 lamps and appropriate lens and mirror optics. All these luminaires are designed to meet ICI recommendations which specify a minimum general color fidelity index of 85 and minimum partial color fidelity indexes of 70. They also limit the power density of incident radiation to maximum comfortable 350 W/m<sup>2</sup> on the object surface. Inasmuch as proper design and application of luminaires for the operating room must ensure a good light spot on the operating table, the requirements regarding the light spot are analyzed in accordance with illumination theory. Considering that a Gaussian light spot with maximum brightness at the center and 20 percent maximum brightness at a 100 mm radius is required, 24 V-65 W halogen-cycle incandescent lamps have been selected for such luminaires with reflectors and engineering calculations are shown to demonstrate the design procedure. Figures 9; references 1.

#### Lighting Equipment Manufactured by Series Production Method at "KINAP" Plant

927K0328E Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 p 24

[factory report; UDC 628.9(085)]

[Abstract] Lighting equipment manufactured by series production method at the "KINAP" plant in Kiev includes: 1) two 200 W models, two 575 W models, one 650 W model, and three 1200 W models of "Yupiter" motion picture projectors; 2) one 500 W - 110/220 V model, one 1000 W - 110/220 V model, and one 2000 W - 110/220 V model of "Svet" luminaire providing broad and scattered illumination of color or black-and-white film objects; 3) 100 x 3 W "Mars-3000lm-220V" model

luminaire providing broad and scattered illumination of documentary and art film objects; 4) AOF-1 luminaire parts for flash lamps synchronized with "Rakurs-672" and SKPZhD studio cameras shooting on color or black-and-white film; 5) 500 W KFO-0.5 model luminaire providing broad and scattered illumination needed for amateur photography and for chemical-photographic processing of invertible materials. Tables 1.

**List of Products Manufactured by  
Scientific-Industrial Association All-Union  
Scientific Research Institute of Illumination  
Engineering" in 1992**

9927K0328F Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 pp 24-25

[Institute report; UDC 628.9(085)]

[Abstract] The list of lighting equipment produced in 1992 by the Scientific-Industrial Association "All-Union Scientific Research Institute of Illumination Engineering" at its three plants covers six categories: 1) luminaires for factory buildings, 2) luminaires for office and public buildings, 3) luminaires for outdoor lighting, 4) luminaires for various other applications, 5) start regulators for electric discharge lamps, 6) pulse firing devices for electric-discharge lamps. At the Lida plant are produced: a) two models of factory luminaire with incandescent lamps, b) ten models of luminaire with luminescent lamps for office and public buildings, c) eleven electromagnetic start regulator models and one electronic start regulator model for electric-discharge lamps, d) seven pulse-ignition device models for electric-discharge lamps. At the Likhoslavl "Svetotekhnika" plant are produced: a) two models of luminaire with halogen-cycle lamps and with plain incandescent lamps, respectively, for outdoor lighting, b) eight models of luminaire with electric-discharge lamps for outdoor lighting, c) one luminaire model for railroad cars, d) five luminaire models for elevators. At the Experimental Manufacturing plant are produced: a) four models (two "Alfa" and two "Orfey") of luminaires with luminescent lamps for office and public buildings, b) one luminaire model for slide demonstration. Tables 1.

**Charter of Illumination Engineering Society**

9927K0328G Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 pp 27-29

[UDC 629.9.061.22(094)]

[Abstract] The charter of the Illumination Engineering Society founded on 25 September 1991 in Moscow consists of six articles: 1) aims, tasks, and basic orientation of activity; 2) bylaws; 3) scope of activity, individual and collective memberships, chapters of the organization, their rights and obligations; 4) management; 5) financial ways and means ensuring self-support and balanced budget; (annual member dues 10 rubles, 5 rubles for students and retirees); 6) reorganization and

dissolution procedures. The Society is broken down into 24 technical committees. Its executive board has: a president (G.R. Shakhparuntsyan); a chairperson of the review commission (Yu.V. Sazhin); an executive vice-president (M.Yu. Kaplinskaya) for regional sections; a science secretary (G.I. Ashkenazi), an engineering secretary, and a treasurer reporting to the executive vice-president; three vice-presidents: for Committees 1-10 (Yu.B. Aizenberg, for Committees 11-19 (A.B. Matveyev), for Committees 20-24 (A.M. Kokinov). Figures 1.

**Conference of Executive Board of Illumination  
Engineering Society**

9927K0328H Moscow SVETOTEKHNIKA in Russian  
No 2, Feb 92 p 30

[Article by M.Yu. Kaplinskaya, candidate of technical sciences, executive vice-president of Illumination Engineering Society; UDC 628.9.061.22]

[Abstract] The executive board of the Illumination Engineering Society held its first conference on 23 October 1991. The board heard and discussed the vice-president's report on preparatory work done since the Society founding on 25 September 1991. The board then adopted eight resolutions regarding the Society's structure, registration, emblem (a 500 rubles prize offered in a competition), equipment of headquarters, expenses for the 1991-92 period, appointment of chairpersons to the Society's 24 technical Committees, documentation, and the next conference to be held by end of December 1991. Tables 1.

**Synthetic Aperture Radar is Used for Studying the  
Earth**

9927K0327A Moscow RADIO in Russian No 6, Jun 92  
pp 3-5

[Article by B. Stepanov]

[Abstract] A short historical review is given in a popular form of the Synthetic Aperture Radar (SAR) development which began in a scientific research institute founded in 1944 for the purpose of developing an airborne radar. The first model of the space laser with SAR was developed in the mid seventies for installation with "Salyut" space vehicle, but it was not implemented. In 1981 the development of a new SAR was completed, but was also not used because of some political reasons. In 1991 the third model known as "Almaz-1" became airborne and is still active today. Potential benefits are described of the SAR application with satellites for observing the Earth's surface, particularly when studying processes or operations on Earth, which require a constant flow of information from the orbit. This includes guiding ships in arctic waters, studying the sea currents, coastal relief, etc. Data obtained with the SAR for

ecologic studies are of inestimable value. Radar information is also useful for geologists, opening new prospects, for example, in determining the real relief in not easily accessible territory. An illustrative example of military application was the war in the Persian Gulf. Very promising is the prospect of a simultaneous recording of the Earth surface condition from space by a radar operating on different wavelengths with different polarization. In conjunction with optical and other methods it can yield unique information.

### Three-Bands Transceiver

927K0327B Moscow RADIO in Russian No 6, Jun 92  
pp 9-11

[Article by V. Sushkov]

[Abstract] The electronic circuit of the "Albatros-3 transceiver and its functioning is described. With this transceiver it is possible to conduct telegraph and telephone communications in the 7.0, 3.5 and 1.8 MHz frequency range. The sensitivity of the receiving channel is better than 5 micro Volts, and the selectivity is not below 60 dB. Because of employment of a passive mixer, built with field effect transistors, the dynamic range of the transceiver is not smaller than 70 dB. The output power of the transmitting channel is 10 W. The transceiver uses the double frequency conversion circuit. The first frequency is fixed at 500 kHz.

### Radiation Monitor-Radiometer

927K0327C Moscow RADIO in Russian No 6, Jun 92  
pp 12-15

[Article by Ye. Klimchuk]

[Abstract] According to the international trade norms the relative radio-activity of food products can not exceed  $1.62 \times 10^{-6}$  Cu or 600 Bc. The radiation control system adopted by the National Radiation Protection Committee in 1989 considers measurements of up to  $10^{-7}$  Cu. Measurements of contaminations below this level are difficult. According to the author of this paper, effective protection of the population living in contaminated areas is possible only if it is provided with an inexpensive instrument capable of measuring the relative radiation activity of food products at the level of international norms. For this purpose a radiation monitor-radiometer was developed. It incorporates a gas discharge counter SBM-20 and is designed for measuring the power of exposed doses of gamma radiation and the density of the flow of particles from surfaces contaminated by the beta-active nuclides. For measurements of relative beta-activity of food products by a "thick layer" method, the instrument incorporates a lead housing, provided with a gas discharge counter SBT-10. Compounds whose beta-particles radiation from the surface does not change with increased thickness are called "thick layered". The advantage of the "thick layer" method lies in that it requires no preliminary weighing of

the specimens. Employment of the lead housing significantly reduces the effects of outside noise, thus increases the limits of the instrument sensitivity. The fundamental engineering characteristics of the instrument are provided. Figures 4.

### Short Wave Tuner

927K0327D Moscow RADIO in Russian No 6, Jun 92  
pp 21-23

[Article by G. Solovyev]

[Abstract] A portable short-wave transistorized tuner is described. The tuner is designed for receiving programs of broadcast stations in the short wave, 5.8...18 MHz frequency range with expansion of any of the six (49, 41, 31, 25, 19 and 16 m) sub-ranges within 200 kHz. A superheterodyne circuit with double frequency conversion is used. The tuner is powered by two batteries with a total voltage of 2.5 V. The electrical circuit of the tuner and the fundamental technical characteristics are: the effective sensitivity - 100 micro Volts, the selectivity by the adjoining channel - 30 dB, the first intermediate frequency - 1840 kHz, the second intermediate frequency - 465 kHz, the output power - 10 mW. The quality of the tuner functioning greatly depends on the accuracy of adjustment and circuit connections. A high quality signal generator is required for making adjustments. Figures 5.

### Flexible Magnetic Diskettes

927K0327E Moscow RADIO in Russian No 6, Jun 92  
pp 28-29

[Article by V. Kuznetsov]

[Abstract] The flexible magnetic diskette format and the diskette mechanism operation are discussed. The logic organization of information in 5-inch diskettes with 80 track for use with IBM PC computers operating under MS DOS command is described. Markings of a formatted track, time relationships of the command signals and relative time relationship between fundamental interface signals are shown in the provided tables. Tables 4.

### Color Module MTs-501

927K0327F Moscow RADIO in Russian No 6, Jun 92  
pp 30-33

[Article by L. Kevesh, A. Peskin]

[Abstract] The function of the MTs-501 color module and frequency tuning procedures are described. The schematic diagrams of the electrical circuit and oscillograms obtained at characteristic points are provided for both, PAL and SECAM systems. The module can be installed with a TV by following the procedures described by the authors of this paper in the article "New Industrial Decoders SECAM-PAL" ("Radio", No 5, 1991). Figures 3.



**Adjustment, Modification and Repair of the Videocassette Recorder "Elektronika VM-12"**

927K0327G Moscow RADIO in Russian No 6, Jun 92  
pp 34-37

[Article by Yu. Petropavlovskiy]

[Abstract] The videocassette recorder "Elektronika VM-12" is very popular, and even though some factories have now began manufacturing new models, it is still produced in large quantities. Therefore, the adjustment and repair of the recorder is an important matter for many owners. This article is an attempt to offer them assistance. The frequency adjustment procedures as well as procedures for testing the performance of the component parts are described and recommendations for improving the performance are provided. Particular attention is given to adjustment procedures of the brightness channel and the color channel. It is also pointed out that with playback of the PAL system recordings of a poor quality, clearly visible narrow horizontal color lines can appear in the upper part of the raster in many VM-12 recorders. After examining the color channel it was revealed that one of the reasons for the inefficient performance lies in the selector of the synchronizing pulses. Recommendations were made for ways to make improvements. Figures 7, references 4 Russian.

**Photosensors**

927K0327H Moscow RADIO in Russian No 6, Jun 92  
pp 57-58

[Article by M. Baranachnikov]

[Abstract] Properties of photosensors are discussed. Their sensitivity, the shut-off current and the emf depend on ambient temperature. The photo-sensors' sensitivity is reduced with heating as well as with cooling. The selenium cells exhibit, so called "fatigue". Stability of the selenium cells' functioning depends, to a great extent, on their intrinsic resistance and the load resistance. The advantages of the selenium cells compared to the vacuum sensors lie in their high sensitivity, and the disadvantages consist in the greater time-lag. When designing devices with selenium cells, their Volt-Ampere characteristic must be taken into account. The photoelectric currents and voltages can be determined from the Volt-Ampere characteristic for different values of the load resistance and the illumination intensity. It is well to remember that the selenium cells can be used only in the Photo-galvanic mode of operation, that is, without applying voltages from an external source. The field of selenium cell applications is very wide. They are used with photometers, luxometers, microphotometers, photographic exposure meters, density meters, etc. Figures 7, references 6 Russian.

**Direct Conversion Receiver on K174PS1 Chip**

927K0326A Moscow RADIO in Russian No 5, May 92  
pp 12-13

[Article by V. Bogdanov, St. Petersburg]

[Abstract] The shortcomings of direct conversion receivers, particularly the need to use a passive mixer and considerably increase their gain which, in turn, increases the unwanted oscillation probability prompted an attempt to use an active mixer on a K174PS1 chip in the receiver; the chip is designed as a double balanced mixer with good frequency and noise properties and has a relatively low input impedance for both the signal and oscillator inputs. The design and operating principles of the chip are described and the electrical circuit diagram of the receiver is cited. The receiver has a 7-7.1 MHz service band and a sensitivity of at least 1  $\mu$ V at a signal:noise ratio of 10 dB. At a 10 kHz detuning, the receiver has a selectivity of at least 35 dB and a gain regulation depth of 50 dB; the power supply voltage is 13.5 V and the current is 30 mA. The receiver was tested with a surrogate antenna under urban conditions and is capable of receiving telegraph and SSB ham signals; it can also pick up medium wave AM stations with precision tuning. Figures 2; tables 1; references 2.

**Phase Modulator**

927K0326B Moscow RADIO in Russian No 5, May 92  
p 15

[Article by A. Rudnev, Balashov, Saratov oblast]

[Abstract] A modulator, intended for use in phase- or frequency-modulated VHF-UHF communications equipment consisting of a pulse-duration modulator (ShIM), a scale-of-two frequency divider (DCh), and a tuned amplifier (RU) is presented. The modulator design and operating principle are outlined and its electrical circuit diagram is shown. The relative pulse duration on the pulse duration modulator output is equal to 2 and the maximum output signal phase deviation in the modulation mode is about 90°. The phase modulator can also be used for FM applications; to this end, the audio signal must be sent through an integrating RC-circuit. Any series KT315 transistor and MLT-0.25 or MLT-0.125 resistor can be used in the phase modulator. Its cutoff frequency is determined by the integrated circuit speed which can be increased by substituting series K155 IC with a faster chip. Figures 2.

**Electronic Knife Switch**

927K0326C Moscow RADIO in Russian No 5, May 92  
pp 17-18

[Article by A. Ivanov, Smolensk]

[Abstract] The sparking, accelerated contact wear, and low reliability which characterized traditional consumer switches and knife switches used in distribution power



networks prompted the development of an electronic "knife switch" capable of controlling loads from several watts to tens of kilowatts; yet these switches have their shortcomings: e.g., a high current consumption even in the deenergized state. Consequently, a new switch version is proposed in which a VS1 triac controlled by a pulse generator with a high relative pulse duration and high repetition frequency performs the function of the switching element. The relative pulse duration is limited only by the make time. Thus, for a KU208G triac the control pulse duration must be at least 10  $\mu$ s. The design and operating principle of the switch are described and its electrical circuit diagram is cited. In the proposed switch, the generator assembled on DD1.3 and DD1.4 logic elements of a K176LA7 chip has a relative pulse duration of 10 and a repetition frequency of 10 kHz; the control unit also contains a power supply, a power amplifier, and an RS flip flop, making it possible to use the device as a network circuit breaker. The device's current consumption is low. The presence of voltage on the device output is used as its serviceability criterion; its principal advantage is the possibility of controlling both active and inductive loads. Figures 1.

#### Radiation Detector

927K0326D Moscow RADIO in Russian No 5, May 92  
pp 18-19

[Article by V. Babin, Chelyabinsk]

[Abstract] The rising environmental awareness and the desire to know the radiation levels prompted the development of a new radiation detector which uses a series 343 galvanic cell and has a consumption current of no more than 15-20 mA. The proposed detector consists of a low-voltage power supply source converter and a multiplier for providing power to a BD1 or BD2 Geiger counter, a VL2 light emitting diode, and a pulse converter unit. The design and operating principle of the radiation detector are explained and its electrical circuit diagram is cited. The detector's principal shortcoming is the lack of a radiation level calibration scale. The use of a low-voltage power supply source makes it possible to utilize a voltage converter suggested by Yu. Vinogradov. The detector testing procedure is outlined. The device employs two 2000NM magnetic circuits, VT1 germanium transistors and VD1-4 germanium diodes, and an SG301S-1 corona discharge stabilizer diode. A high-resistance ear phone and thyatron are used in the detector for audio indication and light radiation display. Figures 2; references 2.

#### Dot Matrix Printer for Radio-86RK

927K0326E Moscow RADIO in Russian No 5, May 92  
pp 23-25

[Article by D. Medukhovskiy, Krasnoarmeysk, Moscow oblast]

[Abstract] The structure, design, electric circuit and schematic diagrams, and driver of a simple "home-made" dot matrix printer for the Radio-86RK micro-computer commonly used by amateur radio operators are discussed and its operating principle is described. The new impact printer equipped with a regular ink ribbon receives data from the computer in the KOI-7 code which is decoded and converted into a bitmap by a ROBOTRON 1156 7 x 5 35-pin print head control unit. A D14 parallel port is used to receive all control signals from the computer. The printer is capable of printing up to 64 characters per line on any paper without perforation and has a speed of about 5 min per page. A standard character generator is used. In the new printer, all complicated functions of the control circuits are transferred to the driver loaded into the Radio-86RK RAM (OZU). To be continued. Figures 2; references 5.

#### Floppy Discs

927K0326F Moscow RADIO in Russian No 5, May 92  
pp 25-26

[Article by V. Kuznetsov, Moscow]

[Abstract] The shortcomings of series RK microcomputers with an external magnetic tape storage, e.g., their slow speed, and the increasing availability and popularity of disc drives prompted the reevaluation of the utility of old drives for amateur radio applications. The history of the floppy disc (GMD) development from the early 8-inch discs to 2-inch discs for laptop computers is reviewed and floppy disc specifications are summarized. The design of the 5.25 and 3.5 inch discs currently used in many countries is described and the difference between single- and double-sided and double- and high-density discs and their recording density (TPI) is outlined. The letter designations of the disc capacity are cited. The operating principles of disc drives and their components, the disc drive interface and its connection to the disc drive controller, and the input and output signals used by the floppy disc drive (NGMD) are outlined and summarized in a table. To be continued. Figures 1; tables 2.

#### MTs-501 Chromaticity Module

927K0326G Moscow RADIO in Russian No 5, May 92  
pp 29-34

[Article by L. Kevesh, A. Peskin, Moscow]

[Abstract] A block diagram of the MTs-501 chromaticity module and the color definition correction system design for Rubin TV sets are presented; the new chromaticity module is intended to replace the MTs-402 and MTs-403 modules and operates together with the PK-402 or PK-403 picture tube boards. The new module is assembled on integrated circuits, making it possible to expand its functional capabilities and decrease the volume of adjustment and tuning operations as well as lower the outlays of materials. The module operates in the SECAM

and PAL encoding standards and can, if necessary, operate in the NTSC standard since the all-purpose multisystem K174KhA32 (MDA4555, TDA4555, A4555D, and UL1285) chip is used in the module. The basic specifications of the new chromaticity module are listed and its general view is shown. The operating principle of the MTs-501 module is explained in detail and the operation of the color definition correction system is outlined; the color difference and luminance signals corrected by the system are plotted. To be continued. Figures 6; tables 1; references 2.

#### **Principal Requirements of Tunnel Lighting and Lighting Fixtures**

927K0312A Moscow SVETOTEKHNIKA in Russian  
No 3, Mar 92 pp 8-9

[Article by N.I. Vasilev, A.S. Pachamanov, V.A. Pekov, Sophia Engineering University and Svetlina Lighting Device Plant, Stara Zagora, Bulgaria; UDC 628.971.6]

[Abstract] Special requirements imposed on the lighting fixtures for road tunnels and underpasses are considered and attention is focused on the 20° vehicle operator's field of view at the entrance to the tunnel. Two types of lighting fixtures (OP)—devices with symmetric and asymmetric light distribution—and the characteristic tunnel zones are examined and the symmetric and asymmetric luminous intensity of both types of lighting fixtures is plotted. Lighting fixture designs are analyzed and the factors which determine the lighting fixture design are discussed. A new series of lighting fixtures developed in Bulgaria is discussed and the principal specifications of the new devices are cited. Figures 5; tables 3; references: 5 Western.

#### **On Vibration Loads on Reflectors for Lighting Fixtures With Fluorescent Lamps**

927K0312B Moscow SVETOTEKHNIKA in Russian  
No 3, Mar 92 pp 11-14

[Article by V.V. Barmin, Ardatov Lighting Engineering Plant; UDC 628.94:621.327.534.15]

[Abstract] The requirements imposed on the mechanical strength of lighting fixtures (OP) and dependence of the luminous parameters of lighting fixtures with fluorescent lamps (LL) on the reflector (O) shape and dimensions are discussed and a trend toward eliminating the stiffening ribs and cores from lighting fixtures in order to save metal is identified; as a result, a task of determining the effect of the standardized vibration loads on the modification of the reflector's geometric dimensions and the luminous parameters of fluorescent lamp fixtures is formulated. To this end, series LSP02-2x36 fixture which belong to the M1 stability class are tested for vibration stability in a special unit developed on the basis of the VED-20 vibration test bench. The lighting fixture designs are examined and the luminous intensity curves of fluorescent lamp fixtures with various types of

reflectors are plotted. The study reveals that standardized vibration loads affect the luminous parameters of fluorescent lamp fixtures with reflectors and the reflector parameters; it is suggested that in making steel reflectors from <1 mm thick sheets, measures be taken to increase their stiffness. Moreover, in testing the vibration stability of lighting fixtures, it is necessary to test them for resonance frequency. The author is grateful to N.A. Lachin, A.N. Moiseyev, and L.F. Turdakova for assisting with the experiment. Figures 9; tables 1; references 4.

#### **Thermal Condition Analysis of Metal Halogen Lamp Envelope**

927K0312C Moscow SVETOTEKHNIKA in Russian  
No 3, Mar 92 pp 17-20

[Article by Ye.S. Kurbatova, E.I. Sokolovskiy, A.I. Solomatin, Ryazan Radio Engineering Institute; UDC 621.327.534:546.13.001.24]

[Abstract] The use of high-intensity light sources (IS) for illuminating plants so as to increase their yield and the need for a comprehensive analysis of the thermal conditions of the structural members of the envelope are noted and a procedure for analyzing the thermal conditions of a metal halide lamp (MGL) envelope which takes into account all factors which determine the heat exchange and heat dissipation is considered. The analysis can be carried out using simple PC's and scientific calculators. The design of DMZ3000 lamp bulb and its modifications are considered. The procedure is used to check the possibility of replacing the custom made DMZ3000 metal halide lamp bulb with the mass produced bulb for the high-pressure mercury lamp DRL1000. A check of the experimental results shows that they are consistent with analytical data and coincide within 5 percent, attesting to the high confidence of the analytical results. Tests of a control batch of modified lamps confirm their good serviceability. The authors are grateful to I.A. Levin for data on thermal condition measurements in DMZ3000 lamps. Figures 3; references 12.

#### **Selecting Neutral Wire Cross Section of Three-Phase Four-Wire Power Lines**

927K0312D Moscow SVETOTEKHNIKA in Russian  
No 3, Mar 92 pp 28-29

[Article by S.A. Klyuyev, VNIPI TPEP; UDC 621.311.1]

[Abstract] The requirements governing the selection of the neutral wire cross section of 220/127, 3x220, 380/220, and 660/380 V three-phase four-wire power lines used with lighting networks are considered and recommendations are developed for selecting neutral wire cross sections of insulated aerial wires and cable power lines for lighting systems with a uniform phase load. To this end, power cables with impregnated paper, plastic, and rubber insulation and cables with aluminum sheathing are considered. Tables 2.

**Halogen-Cycle Incandescent Specular-Reflector Lamps for Luminaires**

927K0311A Moscow SVETOTEKHNIKA in Russian  
No 5, May 92 (manuscript received 19 Dec 91, signed to  
press 27 Feb 92) pp 1-2

[Article by A.S. Ivantsev, candidate of physical and mathematical sciences, All-Union Institute of Light Sources imeni A.N. Lodygin; UDC (621.326:546.13)628.94]

[Abstract] Two new kinds of specular reflectors, paraboloidal and ellipsoidal ones, have been designed for halogen-cycle incandescent lamps. Made of glass with a mirror coating on the inside surface, all can be used for room lighting or photography. All operate at a nominal color temperature of 2800 K. The paraboloidal reflectors form an at least 115 cm long light beam. They match halogen-cycle lamps of the KGZ 12 V-20/35/50/75/100 W, KZG 24 V-150 W, and KGZ 220 V-75/100/150 W series, ensuring a 1000 h long life of KGZ 220 V-75 W lamps and 2000 h long life of all other KGZ lamps. The maximum length and the maximum diameter of the paraboloidal reflectors for 12 V-20/35/50/75 W lamps are 48 mm and 75 mm respectively, their effective aperture being 63 mm in diameter. The maximum length and the maximum diameter of the paraboloidal reflectors for 12 V-100 W, 24 V-150 W, and 220 V-75/100/150 W lamps are 70 mm and 80 mm respectively, their effective aperture being 67 mm in diameter. The scattering angle is  $\pm 8.5^\circ$  for 12 V-20/35/50/75 W lamps,  $\pm 10^\circ$  for 12 V-100 W and 24 V-150 W lamps,  $\pm 3^\circ$  for 12 V-100 W-1 and 24 V-150 W-1 lamps,  $\pm 58^\circ$  for 220 V-75/100/150 W lamps. The ellipsoidal reflectors match halogen-cycle lamps of the KGE 12 V-20/35/75/100 W, KGE 24 V-100/150/250/350 W, and KGE 27 V-450 W series, yielding a useful luminous flux from 220 lm (20 W) to 6000 lm (450 W) and ensuring a 2000 h long life of all KGE lamps. The maximum length and the maximum diameter of the ellipsoidal reflectors for 12 V-20/35/50/75/100 W lamps are 42 mm and 50 mm, their effective aperture being 40 mm in diameter. The maximum length and the maximum diameter of the ellipsoidal reflectors for 24 V-150/250/350 W and 27 V-450 W lamps are 68 mm and 90 mm respectively, their effective aperture being 78 mm in diameter. A major advantage of ellipsoidal reflectors over paraboloidal ones for room lighting is the possibility, by moving the luminaire vertically, to light only the floor or only a part of it with the walls left in darkness or to light the floor and the lower part of the walls with their upper part and the ceiling left in darkness. The bulbs of these KGE lamps are made of frosted glass, to lower the overall brightness and to produce a more uniform illuminance. For special applications are recommended light sources the radiation spectrum of which has been corrected so that it more closely approximates visible solar light with a higher color temperature, ultraviolet and infrared components being effectively eliminated by multilayer interference coatings on both the light bulb and the reflector. Figures 1; tables 2; references 5.

**New Development in Displays With Anti-Stokes Luminophors for Visualization of Weak Infrared Signals**

927K0311B Moscow SVETOTEKHNIKA in Russian  
No 5, May 92 (manuscript received 18 Sep 91, signed to  
press 22 Jan 92) pp 4-7

[Article by A.V. Kurochkin, engineer, O.Ya. Manashirov, candidate of chemical sciences, A.K. Sattarov, doctor of technical sciences, V.B. Smirnov, candidate of physical and mathematical sciences, and O.V. Tsyurupa, candidate of physical and mathematical sciences, Scientific-Industrial Association "Lyuminofor (Luminophor)", State Institute of Optics imeni S.I. Vavilov, and State University, St. Petersburg; UDC 535.37:621.383.4:628.9.035]

[Abstract] Conversion of infrared laser or LED radiation into visible light with the aid of rare-earth ions in anti-Stokes luminophors on electron image tube for visual display of weak infrared signals is considered, small high-speed high-efficiency electron image tubes with luminophors containing  $\text{Er}^{+++}$  ions now being available for conversion of 1.4-1.7  $\mu\text{m}$  near-infrared radiation into an electron flux and subsequent conversion of the latter, after amplification, into visible light by the cathodoluminescence mechanism. In order to extend this method of conversion to farther infrared radiation within various windows covering the 1.4-13  $\mu\text{m}$  range, it is necessary to find luminophors capable of first converting radiation within such a window into 1.4-1.7  $\mu\text{m}$  radiation. In an experimental study of this problem, infrared anti-Stokes luminescence by  $\text{Er}^{+++}$  ions in various polycrystalline luminophors as host substance (thin luminophor layer between two optically transparent substrate layers) was induced either by a light-emitting diode (maximum emission at 1.55  $\mu\text{m}$  wavelength, 50 percent of maximum emission at 1.4-1.7  $\mu\text{m}$  wavelengths, 25 percent of maximum emission at 1.33  $\mu\text{m}$  and 1.75  $\mu\text{m}$  wavelengths, 10 percent of maximum emission at 1.27  $\mu\text{m}$  and 1.8  $\mu\text{m}$  wavelengths) or by a KGM30 V-300 W halogen incandescent lamp through a set of light filters extracting 1.4-1.7  $\mu\text{m}$  radiation, the excitation power density being varied over the 10 mW/cm<sup>2</sup> to 1  $\mu\text{W/cm}^2$  range. The luminescence spectra were analyzed in an apparatus consisting of an MDR-2 monochromator, an electron image tube with an S-20 photocathode, a photomultiplier with an S-1 AgO-CsO photocathode, an electronic amplifier, and a microcomputer in a CAMAC crate. In this way were tested luminophor  $(\text{Y}_{0.5}\text{Er}_{0.5})_2\text{O}_2\text{S}$ , luminophors  $(\text{Y}_{1-x}\text{Er}_x)_2\text{O}_2\text{S}$ ,  $\text{Y}_3\text{xEr}_x\text{OCl}_7$ ,  $\text{Y}_{1-x}\text{Er}_x\text{F}_3$  ( $x_{\text{Er}} = 0.001-0.25$ ), and luminophors containing  $\text{Yb}^{+++}$  ions as well as  $\text{Er}^{+++}$  ions:  $\text{Y}_{1.7-x}\text{Er}_{0.3}\text{Yb}_x\text{O}_2\text{S}$ ,  $\text{La}_{1.75-x}\text{Er}_{0.25}\text{Yb}_x\text{O}_2\text{S}$ ,  $\text{Gd}_{1.75-x}\text{Er}_{0.25}\text{Yb}_x$  ( $x_{\text{Yb}} = 0.001-0.9$ ). They were tested on S-1, S-20, and GaAs photocathodes. The results confirm the high yield of anti-Stokes luminescence by Er ions and the role of Yb ions as sensitizer, the latter enhancing visualization of 0.95  $\mu\text{m}$  infrared signals but degrading 0.82  $\mu\text{m}$  luminescence by Er ions (luminescence by Er ions decreasing



monotonically with increasing Yb content in the luminophor). A resolution of 20-30 lines/mm was attained by combining an S-20 photocathode with the optimum luminophor. A luminous intensity of 1 cd/m<sup>2</sup> on the display screen was already attained by excitations of the luminophor with only a 10<sup>-5</sup>-10<sup>-4</sup> W/cm<sup>2</sup> power density of 1.4-1.7  $\mu$ m radiation, only 0.80-0.84  $\mu$ m anti-Stokes radiation falling within the sensitivity range of an S-20 photocathode. Figures 4; references 19.

#### Management of Emergency Situations in Outdoor Lightning Networks

927K0311C Moscow SVETOTEKHNIKA in Russian No 5, May 92 (manuscript received 18 Jan 91, signed to press 19 Feb 92) pp 11-15

[Article by Yu.P. Lebedev, engineer, V.F. Sokolov, candidate of technical sciences, and V.F. Kharchenko, engineer, Moscow Municipal-Industrial Association "Mosgorsvet(Moscow Municipal Street Lighting) and Kharkov Institute of Municipal Management Engineers; UDC 628.093:621.398]

[Abstract] The problem of open-circuit faults in 3-phase-Y outdoor lighting networks due to breaks in the wiring is considered and a new device which monitors such faults for activation of protective countermeasure is described, a device which monitors the voltage at the output end of a network segment and sends information carried by current pulses to the input end of that segment. The monitor consists of a switching unit and a control unit. The switching unit, a symistor in series with a resistor, is connected between the night-light line conductor and the evening-light line conductor. The control unit, controlling the symistor, is connected between the night-light line conductor and the neutral conductor so that the corresponding phase voltage appears across it. Into the evening-light line conductor is inserted the primary bar of a current transformer which has its secondary winding connected across a protective relay. Both night-light and evening-light contactor coils are, through this relay, connected across the output of another control device. The basic scheme of such a fault monitor has been modified and refined for outdoor lighting networks with mercury-vapor lamps in the luminaires and with the protective relay in the "outdoor lighting" bay at the power source. Figures 5; references 9.

#### Outlook for Improvement of Low-Power High-Pressure Sodium Vapor Lamps

927K0311D Moscow SVETOTEKHNIKA in Russian No 5, May 92 (manuscript received 29 Oct 91, signed to press 22 Jan 92) pp 15-17

[Article by V.S. Litvinov, professor, doctor of technical sciences, N.P. Petrenko, engineer, and L.A. Chumak, engineer, Moscow Institute of Energetics and Poltava Gas-Discharge Lamp Manufacturing Plant; UDC 621.327.532.2]

[Abstract] Following a review of the state of the art in high-pressure sodium vapor lamps generally and low-power (under 250 W) ones particularly, four directions of their improvement are outlined which will further enhance their advantages over other high-intensity lamps for mass consumption. These directions are: 1) optimization of their performance parameters so as to ensure maintenance of constant low lamp power (30-35 W) at a constant lamp voltage to supply voltage ratio of about 0.45; 2) exploration of their performance in the constant-current variable-power mode of operation for possible applications; 3) consolidation of lamp designs into one series or several series to match the same start-regulating apparatus, including the inductive ballasts and the pulsed igniter; 4) comprehensive evaluation of possible design variants ensuring, at a cathode-to-anode voltage drop of only 4-6 V, a luminous output comparable with or as high as that of 400-1000 W high-pressure sodium vapor lamps. For the purpose of identification of the lamp variants most adequately meeting the outlined design and performance criteria, estimates have been made on the basis of theoretical calculations and experimental data. Calculations were made assuming a constant optimum temperature in the cold region, an initial luminous output of the lamp approximately equal to that of its positive column, and independence of that initial luminous output on the interelectrode distance. The results indicate that, for the optimum basic variant of a low-power high-pressure sodium vapor lamp, even a change of nominal lamp power to one third will not require replacement of the start-regulating apparatus and the static converter. They also indicate a possibility of eliminating the pulsed igniter. The next steps will be a reliability analysis and a stability analysis based on test data, also a market research involving producers and users, followed by development of a technology for mass production of low-power high-pressure sodium vapor lamps of by then standardized series. Figures 3; references 17.

#### The Law on Mass Media of the Russian Federation

927K0309A Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 92 pp 3-6

[Article by A. Altayskiy]

[Abstract] Several important articles of the Russian Federation Law on mass media are reprinted here from the text published in the newspaper "Rossiyskaya Gazeta" of Feb 8, 1992. The reprinting of the Law is justified by the fact that this text is difficult to obtain, particularly outside of major centers including foreign countries. The reprinted articles deal with the mass media registration procedures, status and responsibilities of the editorial staff, publication data, issuing of licenses for radio and television broadcast, generation of man-made noise interfering with reception of radio or TV signal, documenting of the radio and TV programs, handling of commercial advertisements, publication of erotic material etc. As a commentary to the Law the

author points out that the statement concerning the rights to a "commercial secret", contained in article 20 of this Law, can be interpreted in a way which would block dissemination of information and that its inclusion in the Law is a result of pressure from financial magnates that gained a political power.

### **Feasibility of Employing Computer Graphics in the Production Technology of Animated Films**

927K0309B Moscow *TEKNIKA KINO* 1  
*TELEVIDENIYA* in Russian No 6, Jun 92 pp 45-49

[Article by I. K. Ignatyev, V. A. Khizder, Scientific Research Institute for Motion-Picture and Photography]

[Abstract] Computer technology can be used for production of animated films which would significantly expedite the process. At least theoretically the routine operations of manual interpolation can be computerized by replacing the full images of the portrayed characters with skeleton models for computer input; the computer would perform a frame-by-frame interpolation with these models followed by a consequent restoration of these images based on the artist's samples. In practical application this approach to restoration of intermediate phases of the portrayed characters motion produced no positive results. The reason lies in a discrepancy between 3-dimensional models of the characters and 2-dimensional interpolation. The simple method for eliminating this discrepancy lies in replacing the 3-dimensional model by a 2-dimensional one. A system for 2-dimensional modeling of characters was developed, significantly simplifying the construction of key motion phases of the 2-dimensional skeleton model because it can be fully controlled on the computer display in the interactive mode. For elimination of the above discussed mismatch, the developed 2-dimensional mechanism of modeling and interpolation must be transformed back to the 3-dimensional one. Figures 4, references 2 Russian.

### **The Present State of the Art and the Development Prospects of Magnetic Recording Medium**

927K0309C Moscow *TEKNIKA KINO* 1  
*TELEVIDENIYA* in Russian No 6, Jun 92 pp 50-52

[Article by Yu. A. Vasilevskiy, L. I. Zelenina, Moscow AO Scientific Research Institute for Photo-Chemical Products]

[Abstract] For the last decade the magnetic recording medium (MRM) has been the major material used for recording and carrying information. Analysis of the global conditions and development prospects of the MRM indicate that it will be widely used for at least the next 20 years with continuing development during the first ten years followed by a gradual tapering off and a transition to a solid state recording medium. This situation is illustrated in a table comparing the MRM production data between 1969 and 1989, a table listing the MRM cost (for countries other than USSR), and in a

table showing the projected development of the recording materials for the period between 1990 and 2010. It is envisioned that during the next decade the digital method of magnetic recording will be developing in all areas of application including audio and video recording. However, this process will be inhibited by a huge supply of traditional magnetic recording medium. It is also expected that for the next ten years the production of high density metallic magnetic medium will be increased. Figures 3, references 8: Russian 2, Western 6.

### **Fiber-Optics Communication Lines for a Commercial Cable TV System**

927K0309D Moscow *TEKNIKA KINO* 1  
*TELEVIDENIYA* in Russian No 6, Jun 92 pp 52-55

[Article by B. N. Pershakov, Z. P. Luneva, Moscow Scientific Research Television Institute]

[Abstract] The feasibility of using fiber optics for cable TV is examined. An optical transmission system can be advantageous only if the specific features of the fiber optical communication are utilized. These features lie in that a wide frequency spectrum can be transmitted for greater distances without repeaters, and that the optical lines are immune to electromagnetic interference; they are not as bulky as the coaxial cables, and are more economical. Most probably application of the fiber optics with cable TV and local fiber optic networks will be guided mainly by the "efficiency-cost" criterion. As a review of the state of the art, different types of possible modulation techniques are discussed, pointing out that a single-mode fiber with zero dispersion is normally used with any type of modulation, and also that when employing laser diodes as a radiation source, no optical interference is produced in the single-mode fiber. Distributed feedback laser diodes, which are used for this purpose, are expensive and are not manufactured in Russia. Directional couplers with about 0.1 dB insertion losses had been developed abroad, but are also not produced in Russia. Digital transmission is the best method well suitable for the fiber optics application. However, at the present time this method is the most expensive. Figures 1, references 3: 1 Russian, 2 Western.

### **Panasonic D-3 Digital VTRs are Being Tested in Moscow**

927K0308A Moscow *TEKNIKA KINO* 1  
*TELEVIDENIYA* in Russian No 5, May 92 pp 19-20

[Article by L. Ch.]

[Abstract] In order to determine its functional capacity the performance of the Digital video recorder model AJ-D350 with D-3 format was tested in the special project studio "Arveks". In the course of these tests the quality of the video and audio signals was evaluated after multiple re-recording. Different compilation techniques of the audio signals were tested without using an external

mixer. Because the analog component Betacam SP format is the most common format employed in Russian TV, the composite signals must be converted into the component signals and vice versa before the composite video magnetic recorders AJ-D350 can be used in the analog component studios, thus with obvious drawbacks of these conversions the advantages of the expensive digital equipment could be lost. The "Arveks" specialists believe that by combining the digital AJ-D350 with the analog Betacam SP editing systems, a repeated high quality re-recording will be possible even after making 10 copies or more. Under the existing conditions a most painless and efficient conversion to the D-3 format can be carried out at operating analog television stations in two stages. During the first stage the available analog camcorders Betacam SP format can be used only for recording, and the combination systems Betacam SP+D-3 for editing, where the analog video recorders are used for reproduction, and the digital camcorders AJ-D310 for editing. During the second stage the digital camcorders, video mixers, DVE generators and other digital equipment can be gradually introduced to complete the conversion to digital technology.

#### **An Original Technique for Drying Large-Size Photographic Material**

927K0308B Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 92 pp 28-30

[Article by Ye. F. Ivanova, A. A. Chekhovich, All Union Scientific Research Institute for Motion-Picture and Photography]

[Abstract] A convective method was developed in the SRIMPP for drying large-size photographic material using high RPM axial fans as blowers. The method is based on a particular distribution and configuration of the drying air flow. Using this method the size of the drying apparatus and the noise level can be significantly reduced while providing an intensive and uniform air flow for drying the material. This method was implemented with a FP-104 X-ray film developing machine which has a 0.38 m drying path. With 80 g/m<sup>2</sup> moisture capacity of the X-ray film moving at 29 m/h, the drying process was completed in 48 seconds at a temperature of 55°C. The power consumption for drying was not greater than 2.5kW. This method can be used with self-contained drying devices as well as with film developing equipment. Figures 2, references 2 Russian.

#### **Draft Package of New Recommendations by International Radiocommunication Consultative Committee (CCIR) on TV. Part 1**

927K0308C Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 92 pp 62-65

[Article by M. I. Krivosheyev, (Chairman of the 11th CCIR Research Committee), V. A. Khleborodov (Vice-Chairman of the 11/2 CCIR Goal-Defining group)]

[Abstract] In order to prepare for the Intermediate conference of the 11th International Radiocommunication Consultative Committee (CCIR) in May 1992, a meeting of all Goal-Defining, and Working groups, as well as the Coordinating group was held from 11th to 27th November of last year with participation of delegations from 29 countries, including delegations from broadcasting organizations, authorized private agencies, and scientific and industrial organizations. Projects for new CCIR recommendations were developed and approved. Numerous recommendations were considered dealing with high definition TV, digital TV video interface, regular and high quality TV, and digital coding of the video signals and reduction of the digital flow.

#### **Fiber Optics**

927K0308D Moscow *TEKHNICA KINO I*  
*TELEVIDENIYA* in Russian No 5, May 92 pp 67-68

[Article by L. Chirkov]

[Abstract] Presentation of Fiber Optics Technology (FOT) Association was held in Moscow on February 21, 1992. This Association which was established a year ago unites 28 organizations representing all states of the Union, including research institutes, design bureaus and industrial enterprises. It is expected that the major objective of the FOT efforts in the near future will be concentrated on the solution of a very urgent task of rapid and comprehensive development of domestic fiber optics communication. Projected construction of Trans-Siberian fiber optics communication line could accelerate the development of the fiber optics, but participation of large foreign companies in this project is questionable. The Trans-Siberian line can be profitable only if the transmission band frequency is not smaller than 2-3 GHz. For our industry this level of multiplexing is practically unattainable, and this is why the participation of leading foreign companies is most desirable. Tremendous lag in the development of information infrastructure in our country must be overcome by using modern technology and communication equipment.



**Analysis of High-Frequency Transistorized Oscillators Operating in the Limiting Mode**

927K0310A Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35 No 1-2, Jan-Feb 92 pp 27-32

[Article by V. N. Kotlyarov; UDC 621.372.011.72]

[Abstract] A spectral method for the analysis of high frequency models of transistorized power amplifiers is discussed in this paper. With this method it is possible to analyze the energy and qualitative characteristics of devices under real operating conditions at the signal input level without the necessity of making estimates of the amplitude characteristic. Algorithms were developed and used in a computer program designed for modeling standard push-pull type transistorized wideband power amplifiers in the high frequency and very high frequency range. Using the results of this modeling a hybrid-integral amplifying module was designed and manufactured capable of delivering 220 W pulsed power with a power gain of 5, operating in the 1.5-30 MHz frequency range, which fully agrees with the design characteristic. This method can be readily extended for design of more complex models. However, the size of the program and the execution time increase significantly with an increased number of elements. Figures 1, references 6 Russian.

**Digital Signal Processing in the Low-Frequency Channel of a Modulation Radiometer**

927K0310B Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35 No 1-2, Jan-Feb 92 pp 33-38

[Article by S. A. Volokhov, S. Ya. Korsakov, A. A. Kochetkov; UDC 621.396:523.164]

[Abstract] To a great extent prospects of increasing the accuracy and sensitivity of radiometers is held back by the shortcomings of the analog low-frequency units which are used with the radiometers. The sensitivity of a radiometer can be increased by reducing the energy band of the low frequency filter (LFF), thus increasing the averaging time. For time constants greater than several seconds this is a difficult procedure not always resulting in an increased sensitivity when using the analog filters with the radiometers. The radiometer's sensitivity can be increased by a digital signal processing. A low frequency unit was developed and tested with different types of radiometers. With this unit the cut-off frequency can vary within 0.5-12 kHz which can provide operation of the entire device with the modulation frequency in the 0.25-1 kHz range. Curves are included showing the sensitivity vs averaging time for the digital and the analog low frequency units operating with a standard PK 718 radiometer and with the experimental unit. Figures 5, references 4 Russian.

**Identification of a Bipolar Transistor Parameters**

927K0310C Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35 No 1-2, Jan-Feb 92 pp 59-62

[Article by D. P. Bumarin; UDC 621.382.3]

[Abstract] A problem of reliability arises with the quality control of radio-electronic equipment when using a parametric identification method because this method belongs to the class of reverse problems and, as a rule, is incorrect. A method was developed for an accelerated and increased stability of the parametric identification and quality control of transistors compared to the familiar approach. This method helps to reduce the sensitivity of the identified parameters of the transistor elements to the external effects. Figures 1, references 4 Russian.

**Information Characteristics of a Limited Stable Noise**

927K0310D Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35 No 1-2, Jan-Feb 92 pp 63-66

[Article by O. N. Maslov; UDC 621.396.96]

[Abstract] White noise with a uniform energy spectrum and normal distribution of instantaneous levels is a widely used mathematical model. In some cases the real noise and noise-like interferences are significantly different from the Gaussian noise. Based on the analysis of the information carrying characteristic of a limited stable noise the following conclusions can be made: Because the differential entropy of the normal noise is maximal compared to other distributions, it can not be assumed that it is the most effective kind of interference. Under real conditions, taking into the account limitations of the dynamic range of the noise, and the transformation of the probability distribution density because of the radio path non-linearity, the efficiency of the real noise is not inferior to the normal noise. The most accurate criteria used for evaluating the noise efficiency is the modified Fisher measure, the Fisher information quantity and the divergence. Figures 3, references 4 Russian.

**Matched Filters of Frequency and Phase-Shift Keyed Signals Using K528KhK1 Microcircuits**

927K0310E Kiev IZVESTIYA VYSSHIKH  
UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA  
in Russian Vol 35 No 1-2, Jan-Feb 92 pp 72-76

[Article by V. P. Vakhrushev, A. A. Abroskin; UDC 621.391.26]

[Abstract] In circuits of matched filters of sequential frequency and phase-shift keyed signals (FPSKS) the output signal is formed by adding the responses from

filters of complex FPSKS elements arriving at the summation circuit by way of the delay lines. Programmable discrete-analog matched filters (DAMF) are used for processing phase-shift keyed signals with charge coupled devices. Application of the DAMF has some advantages over other types of matched filters. However, there are some shortcomings, which can be eliminated by using a FPSKS filter where the convolution and the delay of the response from complex elements is performed in a DAMF made with K528KhK1 microcircuits. Such circuits were developed and their functioning is described. The experimental studies of the modified DAMF built with K528KhK1 and K1146KhK1 microcircuits support the feasibility and advantages of their application for design of matched filters of the FPSKS with a large base. Figures 6, references 5 Russian.

#### **Antiselective Effect With Non-Bragg Volume Diffraction**

927K0295A Nizhniy Novgorod IZVESTIYA  
VYSSHIKH UCHEBNYKH ZAVEDENIY:  
RADIOFIZIKA in Russian Vol 34 No 7, Jan 91  
pp 784-789

[Article by L. S. Priver, Nizhegorod State University Scientific Research Institute of Applied Mathematics and Cybernetics; UDC 621.375.8]

[Abstract] A study was conducted on the feasibility of wide-aperture scanning in a volume diffraction mode by an isotropic crystal with weak interaction of light and acoustic waves. Under these conditions the diffraction angle was greater than the Bragg angle. This scanning mode can be achieved by positioning the acoustooptic element in the laser resonator cavity where the radiation leaves the resonator after diffraction. It was determined that under particular diffraction conditions within a wide range of scanning angles, the first peak intensity gradually increases as the scanning angle varies from the central position which appreciably differs from the Bragg angle. This phenomenon is called antiselectivity of diffraction. The applied significance of the results lies in the feasibility of carrying out a wide-aperture scanning with a large number of elements in the scanning line, under less stringent requirements with respect to divergence and monochromatism of the laser radiation. Figures 3, references 3 Russian.

#### **Asymptotic Behavior of the Eigenwaves of a Smoothly Irregular Planar Waveguide**

927K0295B Nizhniy Novgorod IZVESTIYA  
VYSSHIKH UCHEBNYKH ZAVEDENIY:  
RADIOFIZIKA in Russian Vol 34 No 7, Jun 91  
pp 790-797

[Article by A. D. Avdeyev, V. V. Novikov; Leningrad State University; UDC 621.372.8]

[Abstract] A horizontal beam and vertical modes method and an equivalent method of a two-dimensional decomposition are used for determination of acoustical fields in the three-dimensional non-uniform ocean waveguides. In this paper these methods are generalized for the case of a three-dimensional anisotropic electrodynamic problem, and can be applied for studying propagation of the ultra-long radio waves in the Earth-ionosphere waveguide. A method is developed for asymptotic construction of the eigenwaves, which represent the particular solution of the homogeneous Maxwell equations and are essentially the normal waves in an irregular waveguide. The asymptotic construction of the eigenwaves is obtained in a form that contains no secular terms in the corrections to the adiabatic approximation. The fundamental difference of the examined vector problem from the acoustic problem lies in that the eigenfunction system of the diametrical operator which determines the characteristics of the vertical modes lacks on completeness. References 10: 9 Russian, 1 Western.

#### **Product of Regions Method for the Solution of the Problem of Electromagnetic Wave Diffraction by a Polygonal Dielectric Cylinder**

927K0295C Nizhniy Novgorod IZVESTIYA  
VYSSHIKH UCHEBNYKH ZAVEDENIY:  
RADIOFIZIKA in Russian Vol 34 No 7, Jan 91  
pp 798-805

[Article by A. M. Kotsur, V. P. Chumachenko; Zaporozhye Machine Construction Institute; UDC 537.874.6]

[Abstract] Algorithms were developed for solution of the problem of wave diffraction by a two-dimensional conducting piece-linear object in a resonant frequency range by applying a product of regions method. Problem of the E and H polarized electromagnetic wave diffraction by a dielectric body with a polygonal cross section was solved by this method. The algorithm consists of a computer program designed for computing the scattering characteristics of one or several dielectric cylinders in the resonant range. Results of the numerical study of this method conversion in the case of a planar E and H polarized wave diffraction by a cylinder with a square cross section are shown in a table. Directivity curves of the field scattered by the cylinder are also provided. Accurate characteristics of the field can be obtained with this method. References 10: 9 Russian, 1 Western.

**Effect of Reciprocal Tuning Accuracy of Elements of a Fiber-Optics Ring Interferometer on the Drift of its Zero**

927K0295D Nizhniy Novgorod IZVESTIYA  
VYSSHIKH UCHEBNIKH ZAVEDENIY:  
RADIOFIZIKA in Russian Vol 34 No 7, Jan 91  
pp 817-823

[Article by G. B. Malykin, USSR Academy of Sciences  
Institute of Applied Physics; UDC 621.373;535.8]

[Abstract] Polarization non-reciprocity in a fiber-optical ring interferometer (FORI) causes the initial phase difference which is related to variations in consecutive measurements of polarization characteristics of the radiation propagating in opposite directions. Change of the radiation polarization characteristics is determined by the polarization characteristics of a single-mode fiber optic lightguide (SFOL), which includes birefringence, coupling coefficient of the orthogonal, linearly polarized eigenmodes of the SFOL, and the orientation of the SFOL axes with respect to the polarizer axis. The effects of the reciprocal tuning accuracy of the FORI elements were examined in this paper. It was demonstrated that the FORI zero drift consists of two parts: a constant part and a varying part, related to the temperature changes. The both parts depend on the condition of the radiation polarization at the polarizer output, the extinction coefficient of the polarizer and the orientation of the SFOL with respect to the polarizer. In addition, the varying part of the zero drift depends on the value of birefringence and the SFOL h-parameter, and also on the width

of the radiation source spectrum. Numerical estimates were made of the zero drift and it was shown that the drift can be reduced by the factor of 10.

**Feasibility of Using a Frequency-Angle Method for Probing the Ionosphere**

927K0295E Nizhniy Novgorod IZVESTIYA  
VYSSHIKH UCHEBNIKH ZAVEDENIY:  
RADIOFIZIKA in Russian Vol 34 No 7, Jan 91  
pp 850-853

[Article by V. G. Galushko, USSR Academy of Sciences  
Radioastronomy Institute; UDC 621.371:550.388.2]

[Abstract] Solution of the reverse problems of reconstructing the electrons' concentration profile using the ionosphere diagnostics methods is based on measurements of frequency dependence of the signal group delay time. Phased-array antennas with a 1° beam pattern can measure the signal arrival angle with a high accuracy. This feature can be used for ionosphere diagnostics based on measurements of the arrival angle with inclined radio paths at several frequencies. Plane-stratified isotropic ionosphere probing by monochromatic signals was numerically modeled for a 640 km range using several frequencies. The results of modeling indicate that the initial profile can be determined with a high accuracy. The maximum error was in the upper region of the profile and comprised a few percents. Thus, a feasibility was demonstrated of reconstructing the electron concentration profile from measurements of the arrival angle dependence on frequency. References 3 Russian.



**Magnetoelastic Effects With Participation of Higher-Order Exchange Magnetostatic Thickness Modes in Ferrite Films: Review**

927K0323A Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 26 Jul 91) pp 961-977

[Article by A.S. Bugayev and V.B. Gorskiy; UDC 539.216.22:536.635]

[Abstract] Results of theoretical and experimental studies concerning magnetoelastic effects with participation of higher-order exchange magnetostatic thickness modes in planar ferrite films on planar bulk substrates are reviewed, considering that magnetoelastic interaction of such modes in such films is possible at frequencies above 4 GHz and therefore can be utilized in the development of magnetically tunable microwave devices. Interaction of spin waves and elastic waves in bulk ferrite crystals is considered first. Their interaction in ferrite films is then described in accordance with these authors' theoretical analysis, which also covers resonance magnetoelastic interaction of exchange magnetostatic oscillations, and by citing the results of experiments performed with Y-Fe garnet films on Ga-Gd bulk substrates. Such experiments have revealed that interaction of dipole magnetostatic oscillations and elastic modes strongly distorts the resonance curve of the former and, when their resonance frequencies coincide, produces a dip in that resonance curve. They also confirm the theory that even in thick ferrite films exchange magnetostatic oscillations, when in phase synchronism with elastic modes, are coupled to elastic modes much stronger than are dipole magnetostatic oscillations. The review continues with magnetostrictive excitation of hypersonic elastic waves in ferrite films: their excitation by dipole magnetostatic oscillations, by exchange magnetostatic waves, and by hybrid dipole-exchange magnetostatic oscillations. The review concludes with resonance magnetoelastic interaction of exchange magnetostatic waves attending nonlinear parametric excitation of spin waves in phase synchronism with elastic waves, strong magnetoelastic interaction in ferrite films significantly shifting the nonlinearity threshold along with the entire nonlinear process. While spontaneous combination scattering of a dipole magnetostatic wave by elastic waves it has generated does occur near the magnetoelastic resonance line with attendant excitation of low-order acoustic Lamb modes, elastic modes remain coupled most strongly to exchange magnetostatic waves. Therefore, of special interest are nonlinear processes which involve exchange spin-wave modes such as longitudinal pumping of spin waves. Magnetoelastic interaction evidently raises the power threshold for parametric spin wave excitation and thus the instability threshold for exchange magnetostatic waves. This is demonstrated by three-wave instability of a surface magnetostatic wave in a tangentially magnetized ferrite film, a traveling surface magnetostatic wave being parametrically split into two backward volume magnetostatic waves in higher-order thickness modes

and interaction of these two waves then producing secondary surface magnetostatic waves. Magnetoelastic interaction evidently also raises the threshold of four-wave instability for magnetostatic oscillations in a normally magnetized ferrite film, resonance interaction of secondary spin waves and elastic waves moreover causing this threshold to fluctuate. The frequency dependence of this threshold for dipole magnetostatic oscillations was studied in an experiment with ferrite-film resonator cavities. The evidence thus shows that, unlike in bulk ferrite crystals, in ferrite films resonance magnetoelastic interaction of secondary spin waves will significantly shift the instability threshold for a primary magnetostatic wave. Figures 5; references 42.

**Diffraction of Plane Monochromatic Wave by Slit of Infinite Length in Screen of Finite Thickness**

927K0323B Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 20 Mar 91) pp 978-983

[Article by Ye.A. Galstyan and O.V. Gornostayeva; UDC 538.562]

[Abstract] Diffraction of a plane monochromatic wave by edges of a long straight slit in a plane ideally conducting screen of finite thickness is treated mathematically by a rigorous method of approximation, inasmuch as an exact analytical solution is attainable only for an infinitesimally thick screen. The problem is tackled as a rereflection problem involving multiple scattering and is solved by the Wiener-Hopf method in the Jones formulation, with the aid of already known solutions to two auxiliary problems: diffraction of a plane wave by a semi-infinitely long flat waveguide with an infinitely wide flange and emission of a wave in an arbitrary waveguide mode by such a waveguide. A screen of finite thickness with an infinitely long slit is accordingly represented as a structure consisting of two such waveguides one behind the other, each simply and adequately describable by a generalized scattering matrix. An exact analytical solution to the main problem is then obtained in the form of Neumann series containing infinite-order matrices, their replacement with finite-order matrices yielding the sought approximate solution suitable for numerical analysis. Passage of an electromagnetic wave through a slit in a screen of finite thickness is considered, most appropriately in the long-wave approximation. In this approximation have been numerically evaluated the frequency dependence of the transmission coefficient and the field distribution over the slit for wide range of wavelength for various screen thicknesses, slit widths, and angles of wave incidence. From the approximate analytical expressions for the frequency-dependent transmission coefficient, its maximum-to-minimum ratio, and relative half-width of the resonance curve (ratio of its half-width to the wavelength) has been obtained an expression for the resonance frequencies which applies to all electromagnetic waves except TEM-mode ones. Figures 4; references 5.

**Electrodynamics of Cavity Loaded by Waveguide Operating in Single Mode**

927K0323C Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92  
(manuscript received 25 Apr 91) pp 984-990

[Article by O.V. Gerashchenko; UDC 621.385.6]

[Abstract] The electrodynamic behavior of an arbitrary closed cavity inside ideally conducting walls with one hole or several holes coupling it to an arbitrary semi-infinitely long regular waveguide with ideally conducting walls terminating into an impedance load is analyzed, for an evaluation of the electromagnetic field induced in such a cavity by a given extraneous volume electric current. An arbitrary excitation current characterized by a complex amplitude of its volume density vector  $j(r)$  is assumed to flow inside the cavity and the waveguide is assumed to operate in a single mode only, waves of all other modes either not being generated or not propagating and exponentially decaying to zero at infinity. The analysis is based on two theorems. The particular theorem states that if  $j(r) = j^*(r)$  at all radii  $r$  inside the cavity, then the real part of the induced electric field  $E(r)$  depends neither on the excitation current nor on the reflection coefficient except for some multiplication factor. The generalized theorem extends this independence to the real part of an electric field equal to the sum of  $N$  components. For proof of the particular theorem based on the two Maxwell curl  $E$  and curl  $H$  equations for the electric field induced by a harmonic excitation current, the problem of excitation of a cavity under load (with  $N=1$ ) can be reduced to the problem of excitation of a cavity under no load (with  $N=0$ ) and thus a lossless one. This can be done by selecting such a waveguide mode that at some instant of time the transverse electric field component vanishes over some entire cross-section of the waveguide. For calculating the active power in interaction of the excitation current and the induced electric field, an expression is derived for the real part of the microwave impedance of a cavity under load (with  $N=1$ ). Figures 1; references 3.

**Principles of Designing Antenna Systems Adaptable to Intrinsic State**

927K0323D Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92  
(manuscript received 28 Feb 91) pp 1000-1010

[Article by V.I. Gusevskiy, E.A. Lidskiy, and S.V. Ryzhkov; UDC 621.396.494]

[Abstract] Design of antenna systems adaptable to their intrinsic state is considered as a solution to one problem of electromagnetic compatibility assurance especially important in satellite communication systems, namely retention of the given level of side lobes or the interference immunity of transmission in certain directions during failure of individual system elements equipped with built-in automatic control. Inasmuch as the

problem reduces to that of stabilizing the system performance parameters, a stability criterion is introduced in the form of the functional  $\Phi = \min_{\text{all } r} \min_{(\text{all } q)} T_{qr}(r)$  ( $r$  - antenna set approximating given set of amplitude-phase distributions or control signals,  $q$  - radiation pattern of antenna sets within scan sector,  $T$  - time required for computing fixed set of amplitude-phase distributions) which applies to phased antenna arrays and to hybrid reflector antennas (also to combinations of reflector antennas and peripheral antenna arrays). A model of "fault" situations is proposed, in the phase plane in accordance with the theory of reliability, on the basis of which efficient corrective algorithms can be used for restoration of the original radiation pattern. The method of aperture orthogonal polynomials has been selected for retaining the location of its zeroth-order dip in the direction of interference and stabilizing the maximum of its major lobe with minimum gain reduction, while algorithms of the matrix type can be used for calculating the phase distribution over the corrective antenna system elements and with this information restoring the direction of the major lobe. Such calculations have been made for a linear phased antenna array of consisting of 40 elements and for an asymmetric hybrid reflector antenna with a quasi-optical system for radiation pattern formation, this antenna consisting of two space-diverse feedthrough arrays: the inner one (subarray) forming, with the aid of controllable phase shifters, a stipulated amplitude distribution at the input to the outer array of radiators. The results confirm that the probability of failure of such antenna systems within some given time is much lower with than without adaptation. The authors thank Ya.S. Shifrin for crucial comments on this subject. Figures 6; references 17.

**Directional Couplers Formed by Corner Transmission Lines**

927K0323E Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92  
(manuscript received 18 Jun 91) pp 1010-1013

[Article by V.I. Gvozdev, G.A. Kuzayev, and V.A. Shepetina; UDC 621.396.6]

[Abstract] Microelectronic microwave directional couplers consisting of corner transmission lines are considered: a longer transmission line and a shorter transmission line being each bent into an equilateral square angle with their dielectric substrates (dielectric constant  $\epsilon_1$  and  $\epsilon_2$  respectively) on the inside and their planar film conductor on the outside (conductor of the shorter angle split at the corner), then joined together to form two T-squares around a square hole which is then filled with a dielectric material ( $\epsilon_2$ ). The frequency characteristic of such a device and the dispersion characteristics of its effective dielectric constant (ratio of wavelength in air to wavelength in dielectric medium) were measured in an experiment with a dummy directional coupler. The dielectric materials in this dummy were FLAN-10 ( $\epsilon_{r1} = \epsilon_{r2} = 10$  and FLAN-3 ( $\epsilon_{r3} = 3$ ). The planar conductors had

been deposited on the substrates by the photolithographic process with subsequent chemical etching. The angles were joined dielectric-to-dielectric under pressure after the contact surfaces had been treated with toluene solution. The dispersion characteristics for an even-mode wave ( $\epsilon + 1/2$ ) and for an odd-mode wave ( $\epsilon - 1/2$ ) were measured by the resonance method. Two other such directional couplers were built and tested: the first one with both angle conductors on a common angle substrate in an L configuration, the arms of the shorter conductor on the inside parallel to the arms of the longer conductor on the outside and the outside conductor split at the corner. The second one had the form of a staircase consisting of two L structures (step and riser) with separate angle conductor each on the front side and a common angle conductor on the back side. The test results confirm the authors' topological theory of natural-mode waves. Figures 2; references 5.

# **Quasi-Optimum Signal Processing in Charge-Coupled Devices by Storage and Partial Readout Method**

927K0323F Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 11 Feb 91) pp 1024-1037

[Article by Yu.R. Vinetskiy, M.A. Trishenkov, and M.V. Pykhova; UDC 621.391.01]

[Abstract] A method of optimum signal processing in charge-coupled devices is proposed which makes a nearly maximum theoretical signal-to-noise ratio attainable with minimum hardware complexity, requiring neither extra chip area nor extra power. Conventional signal storage is demonstrated on detection of a radiation "point" source submerged in a uniform background noise and determination of its coordinates by scanning of its image, considering that the photodetector output signal has usually a Gaussian waveform and is modulated by a cos-square pulse with a  $\sin 2\pi fT/2\phi[1 - (2\pi fT)^2]$  spectrum ( $T$  - effective pulse duration). Noise at the photodetector output is assumed to be an additive stationary "white" one with an  $S(\omega) = 2eI$  spectral density ( $e$  - electron charge,  $I$  - equivalent "shot noise" current in noise source). The maximum signal-to-noise ratio is attained by passing the signal and noise mixture through a linear optimum filter whose pulse response characteristic has the form of a cos-square curve and then continually comparing the filter output signal with a given threshold level. This method, when extended to multi-element systems with multiplexing and either an RC-filter or a storage-filter, encounters difficulties on account of the output signal of each photosensitive element being detectable only at discrete instants of time. To facilitate the description of signal processing in such a system, the processing of a signal in the channel of each photosensitive element is split into two stages: continuous filtration involving convolution of the signal and the pulse response function of the filter followed by time discretion in steps equal to the interrogation period.

Transformations taking place in the first stage are amenable to Fourier analysis. Time discretion leads to a loss of invariance of signal arrival time, owing to dependence of the recorded maximum signal value on the position of the corresponding instant of time relative to the readout time. Inasmuch as storage in charge-coupled devices is difficult to implement when the averaging time is longer than the discretion step, three other methods of signal processing in them are considered: 1) nonerasing readout with "floating" gates, requires complex hardware for implementation; 2) formation of replicas by division of charge, not requiring charge-to-voltage conversion but requiring divider and complex other hardware; 3) storage and partial readout, most simple and quasi-optimal. In this method the charge is, upon leaving the optimum filter, stored within a time period  $T$  in the potential well under two gates A and B separated by a thin electrode, this potential well acting as a "potential" knife. When the "knife" potential is quickly raised before the end of the storage cycle, an  $M$ -th fraction of the total charge becomes detached from the rest ( $M$  - ratio of total area of storage device to area of storage cell B). The advantages of this method are revealed in the pulse response characteristic, the transfer ratio, and the amplitude-frequency characteristic of the partial-readout device, these advantages being realizable only when its intrinsic noise is much weaker than that in the entering charge flux. As the fraction is decreased ( $M$  increased) asymptotically, the pulse response characteristic of the partial-readout device approximates the envelope of the pulse response characteristic of an RC-integrator. The optimum divisor  $M$  is shown to increase almost linearly with increasing ratio of pulse duration to interrogation period, being almost the same with the pulse timing anywhere from most favorable to least favorable relative to the readout time. The signal detection threshold is, moreover, independent of the signal arrival time. Figures 7; references 17.

# **Raising Guaranteed Interference Immunity of Pseudonoise Signal Processing Devices**

927K0323G Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 25 Jun 91) pp 1043-1050

[Article by D.G. Kozlov and S.V. Lyuzin; UDC 621.391.01]

[Abstract] Using fail-proof methods based on the theory of games, the authors have synthesized an optimum demodulator of binary useful signals submerged in interference of arbitrary form but limited peak power. This demodulator, intended for receivers of phase-shift-keyed pseudonoise signals with wide base used in radio communication and particularly for receivers of very weak such signals. It consists of a noninductive nonlinear member with an  $f(x) = \tan(kx)$  response characteristics, a corrector, and a threshold device. In addition to this demodulator, such a receiver includes apparatus for tracking the time delay of a pseudorandom sequence, for automatic phase-lock control of the carrier frequency



control, and amplitude estimation. For raising the guaranteed interference immunity of this demodulator, the authors propose new algorithms of its operation with the receiver in the tracking mode and in the coherent mode respectively. These algorithms are nonlinear and ensure a signal-to-noise ratio about 10 dB higher than correlation algorithms. They require continual estimation of the maximum peak power of the interference, which needs to be but usually is not a priori known and may slowly vary in time. The estimate of signal amplitude is unbiased no matter how the interference envelope and phase vary in time. References 11.

### Invariance-Group Principles of Optimization of Readings of Pulsed Multichannel Radar in Complex Multiposition Measurement System

927K0323H Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 12 Sep 91) pp 1050-1056

[Article by V.V. Khutortsev and A.A. Strotsev; UDC 621.391.01]

[Abstract] The problem of optimizing the performance of a pulsed radar is tackled on the basis of invariance-group principles, a multichannel pulsed radar operating within a complex multiposition measurement system being considered and the problem being to optimize its readings of observed objects. Two vector differential equations describe the dynamics of  $j$  moving objects, namely their Gaussian random displacement vector  $X_j$  and the vector  $A_j$  of influencing parameters. These equations contain a known matrix of real coefficients  $A_j$ , a known vector of real coefficients  $B_j$ , and a known continuous vector function  $\Psi_j$  representing the  $j$  laws of motion. A multiposition measurement system is considered which consists of one discretely measuring pulsed multichannel radar and  $K$  continuously measuring direction or range finders, their readings being described by two vector equations for  $Y_j^*$  and  $Y_j(t)$ . The optimum control of readings  $U_i$  ( $i = [0, D]$ ) is synthesized for such a system on the invariance-group basis, the optimality criterion being selected the maximum of some appropriate function. The algorithm of its synthesis consists of six steps, only five steps and one of them modified when both the estimate of the displacement vector and the covariance matrix of the estimate errors are described by stochastic equations. Synthesis of an optimum control  $U_i$  where  $i = [0, 10]$  is demonstrated, assuming  $j = [1, 3]$  objects and accordingly  $p = [1, 3]$  admissible controls. The algorithm of its synthesis by the conventional method involves in such a case numerical integration of those equations and subsequent steps for each  $i$ . This algorithm is, however, ineffective when the  $C_j$  matrices of coefficients in the equation for the covariance matrix of estimate errors are stochastic. References 9.

### Discrete Method of Analyzing Characteristics of Detection-Discrimination of Correlated Signals Appearing With Correlated Background Noise

927K0323I Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 37 No 6, Jun 92 (manuscript received 20 Sep 90) pp 1057-1063

[Article by V.I. Kurlovich and S.R. Geyster; UDC 621.396.96]

[Abstract] A new method of analyzing the performance of systems for detection-and-discrimination of correlated signals appearing with correlated background noise is proposed, a discrete method which covers a wide range of operating conditions and is mathematically simple. At the detector-discriminator input may appear either a discrete sample  $X$  which either contains only background noise  $X_0$  (condition  $A_0, g = 0$ ) or is an additive mixture of signal  $X_s$  and background noise  $X_0$  (condition  $A_s, g = [1, M]$ ;  $M$  - number of signal types). Both signal and noise are assumed to be complex stationary random processes with a normal distribution and a zero mean each, the covariance matrix of each assumed to be known. Processing the sample amounts to formation of biased quadratic functionals and testing hypotheses in accordance with the appropriate decision rule. Analysis of the detector-discriminator performance according to this method is based on three premises: 1) that a quadratic functional can be represented as the sum of  $N$  weighted squares of the moduli of noncorrelated complex amplitudes; 2) that an infinite number of received-sample realizations can be represented as a finite number of discrete approximations of the squares of moduli of noncorrelated complex amplitudes and then be calculated for the specific condition  $A_s, g = [0, M]$ ; 3) that to every nonrandomized decision rule for every possible signal approximation there corresponds a definite decision  $A+k$ . The input data for calculating the detector-discriminator characteristics are the covariance matrices of input sample realization  $R_{s+0} = R_s + R_0$ , the processing matrices  $P^k$ , and the values of bias  $a_k$  ( $k = [0, M]$ ). The conditional probabilities of false alarm and correct detection-discrimination ( $k, g = 0, 1, 2$ ) or correct discrimination only ( $k, g = 1, 2$ ) are calculated by using the eigenvalues of that covariance matrix  $R_{s+0}$  and of the determining matrix  $V^{k/a} = R_{s+0} P^k$ . The method is demonstrated on detection and discrimination or only discrimination of two types of signals ( $M = 2$ ) on the basis of two readings ( $N = 2$ ). Its errors due to signal discretion are estimated for the case of a decision rule involving two alternatives, in which case the detector-discriminator characteristics can be determined in a rigorous analytical manner, but the method applies to detection-and-discrimination problems with any number of decision alternatives. Its advantage is that it does not involve the mathematically difficult task of determining the distribution of a random quantity. Figures 1; references 6.

### Fiber-Optic Light Attenuator

927K0323J Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA in Russian* Vol 37 No 2, Jun 92  
(manuscript received 21 May 90) pp 1137-1140

[Article by P.V. Adamson; UDC 621.372.8:535.39]

[Abstract] A light attenuator is described which consists of two parallel but weakly coupled cylindrical step-index single-mode optical fibers A,B in an immersion fluid. Fiber B with a larger outside radius absorbs light its core (c) and sheath (b) having complex refractive indexes  $n_{b,c} = n_{b,c}' - jn_{b,c}''$  ( $n_{b,c}'' \ll n_{b,c}'$ ). Both indexes  $n_{b,c}'$  and  $n_{b,c}''$  are assumed not to depend on the frequency of the light. Fiber A with a smaller outside radius and the immersion fluid are both transparent, their refractive indexes being real. The refractive index  $n_a$  of the sheath (a) in fiber A and the refractive index of the immersion fluid are both equal to the real part of the refractive index  $n_b'$  of the sheath (b) in fiber B. Both fibers are nondirectional so that polarization effects may be ignored. A performance analysis of such a composite attenuator-waveguide in accordance with the standard scalar theory of coupled waveguide modes is followed by a numerical design analysis of a signal attenuator built with glass fibers for an optical transmission line operating at the 1.3  $\mu\text{m}$  wavelength: core made of 92.1  $\text{SiO}_2$  + 7.9  $\text{GeO}_2$  glass, sheath made of pure  $\text{SiO}_2$  glass. One of the fibers is doped with ions of transition metals (Cr,Fe,Ni, Cu) so as to make it absorb light. The refractive indexes and their dispersions have been calculated according to Sellmeier's formula (M. Adams; Introduction to Theory of Optical Waveguides). The attenuation coefficient is almost the same for light within the 1.3+/-0.01  $\mu\text{m}$  spectral band and is very sensitive to the distance between fibers (2.56 dB/cm when  $d = 10 \mu\text{m}$ , 0.89 dB/cm when  $d = 11 \mu\text{m}$ , 7.4 dB/cm when  $d = 9 \mu\text{m}$ ). The device can also be used as a band-stop filter, inasmuch as the difference between the refractive indexes of the two fibers for waveguide modes  $N_a, N_b$  is approximately proportional to the frequency deviation  $\omega - \omega_R$  when the waveguide mode of each fiber separately has a different dispersion characteristic. Figures 1; references 11.

### Planar Semiconductor Ribbon Grid-Based Nonreflecting Structure

927K0321A Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA in Russian* Vol 37 No 5, May 92  
pp 812-818

[Article by V.I. Ponomarenko, S.I. Zhuravlev; UDC 537.874.7.01]

[Abstract] The electromagnetic wave absorption by a periodic structure shaped as a planar grid made from semiconductor ribbons lying on a dielectric layer is investigated; the grid is an analogue of a resistive-capacitive film and is characterized by the capacitive component of surface impedance which can be controlled by altering the grid configuration. The ribbons

have a negligible thickness while the insulating layer is applied to the surface of a metallic mirror. A planar electromagnetic wave is normally incident upon the structure. The problem of diffraction is formulated and solved and the dependence of the surface structure reflectance on the relative wavelength is plotted. The structure parameters are analytically approximated and the results of numerical calculations are discussed. The structure bandwidth is computed for the four versions under study and is compared to that of a quarter-wave absorber. It is shown that compared to a quarter-wave layer of the same thickness matched to the same wavelength as the structure under consideration, the latter may have a greater bandwidth given a proper parameter selection. The study confirms that the structure can be matched to free space at the requisite wavelength by selecting the ribbon grid and insulating layer parameters while approximate values of the structure parameters can be determined by analogy to the resistive-capacitive film. It is speculated that the findings can also be extended to a three-dimensional system since the electromagnetic wave interacts poorly with the system of narrow gaps parallel to the electric field vector. Figures 2; tables 1; references 4.

### Topological Models of Eigenwaves in Coupled Corner Transmission Lines

927K0321B Moscow *RADIOTEKHNIKA I  
ELEKTRONIKA in Russian* Vol 37 No 5, May 92  
pp 826-833

[Article by V.I. Gvozdev, G.A. Kuzayev, V.A. Shepetina; UDC 621.396.6]

[Abstract] Implementation of bulk integrated circuits (OIS) in radio engineering systems for improving the mass and dimensional indicators and technical characteristics of equipment calls for searching for optimum base elements (BE) which execute the microwave (SVCh) signal distribution and processing functions in the bulk integrated circuit horizontal and vertical planes; to this end, coupled corner transmission lines (LP) with orthogonal conductors are suggested. The results of theoretical and experimental studies of new coupled corner transmission lines whose design is characterized in that the conducting strips are located near the breaks, bends, and corners of the insulating base and the bulk integrated circuit shield thus making it possible effectively to utilize the circuit volume and attain optimum electric parameters due to the physical properties of the corner transmission lines are presented. A topological approach to analyzing eigenwaves in coupled corner transmission lines which makes it possible to calculate the electromagnetic fields accurately within the line of force pattern topology is considered. A general topological simulation algorithm and field topology development in the coupled corner line are examined in detail and the coupled transmission line and base bulk integrated circuit element designs are presented. The odd and even waves' electric field topology is plotted. It is shown that the proposed approach can be used for proximate analysis of

the physical properties of complex three-dimensional circuits and systems. Figures 3; references 9.

#### Use of Strip Radiators in Antenna Arrays

927K0321C Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 37 No 5, May 92* pp 834-840

[Article by V.I. Chulkov; UDC 621.396.677.494]

[Abstract] Growing interest in analyzing the properties of resonant microstrip radiators in antenna arrays (AR) whose use limits the service bandwidth (RPCh) to 35 percent at a VSWR of 1.5 is noted and an attempt is made to demonstrate the possibility of simultaneously ensuring a wide service band and a scanning angle sector of  $\pm 60^\circ$  in the principal planes by using microstrip radiators in antenna arrays with small electrical dimensions located above the impedance surface. To this end, a mathematical model of a planar periodic array from strip conductors (LP) located parallel to the plane on which surface impedance is defined is developed. The design of an infinite planar array with a small period is shown and the radiation patterns and reflectance modulus of the strip conductors are plotted. Given a surface impedance greater in magnitude than the characteristic impedance of free space, the frequency span ratio reaches 2.0 or more within a  $120^\circ$  sector in the principal planes. This confirms the possibility of developing a superwideband (an octave or more) and wide-sector array by substituting the traditional resonant microstrip radiators with radiators having small electric dimensions located above the complex impedance. Figures 3; references 7.

#### Analysis of Dispersive Fourier Processors Allowing for Frequency Translation Characteristics

927K0321D Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 37 No 5, May 92* pp 876-882

[Article by G.V. Pevtsov, V.I. Kostetskiy; UDC 681.7.063:621.37.39.534]

[Abstract] Signal processing in dispersive Fourier processors (DFP) whose operation is based on the direct linear frequency-modulated transform (LChM) is analyzed and two types of algorithms are distinguished depending on the sequence in which the principal operations are executed: multiplication, convolution, multiplication (PSP) or convolution, multiplication, convolution (SPS). Compression filters (FS) and LFM converters (LChMP) consisting of LFM generators (LChMG), mixers (SM), and band-pass filters (PF) are used for executing the convolution and multiplication operations. Block diagrams of PSP and SPS dispersive Fourier processors and frequency-time charts for analyzing both types of dispersive Fourier processors are plotted. The possibility of using

different frequency translation methods in LFM converters is investigated and it is shown that regardless of the frequency translation type, the signal on the output of all devices is linearly related to the direct Fourier transform modulus. The type of LFM conversion determines the signal carrier frequency on the dispersive Fourier processor output and the frequency scanning sequence within the Fourier processor analysis band. In addition, in the SPS mode the translation type determines how the frequency scanning sequence is proportionate to the current position of the "sliding" signal section on the dispersive Fourier processor input. Figures 3; references 8: 7 Russian, 1 Western.

#### Effect of Plasma Jet Injected From Spinning Weather Rocket on Doppler Radar Speed Measurement Errors

927K0321E Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 37 No 5, May 92* pp 883-887

[Article by V.B. Avdeyev, A.P. Yarygin; UDC 621.396.969.1:538.574]

[Abstract] A method of injecting steady plasma jets into the ionosphere from meteorological rockets for actively affecting the ionosphere and using Doppler radar for measuring the rocket motion rate and the shortcomings of the method due to frequency fluctuations leading to errors are discussed and an attempt is made to demonstrate in the two brilliant points model approximation that under continuous or periodic plasma jet injection from a spin-stabilized weather rocket, considerable fluctuations of the Doppler "rocket + jet" system frequency may develop and that these fluctuations are commensurate on the order of magnitude with the rocket velocity. According to the brilliant points model, the resulting composite signal received by the radar antenna is a function of the echo signals from the rocket and the jet. A model of the spinning rocket and jet illuminated by the radar wave and the dependence of the Doppler rocket velocity error on the jet rotation angle relative to the radiation direction are plotted. A statistical analysis of the velocity measurement error shows that in the case of periodic injection at an arbitrary injection start angle in the integrating Doppler channel, the absolute value of error is roughly equal to 0.2 and 114 m/s, respectively, for the two jets under study. In other words, in the case of the larger jet errors are eliminated with lesser efficiency. The findings confirm the possibility of affecting the Doppler velocity measurement errors by plasma jets. The authors are grateful to P.S. Filatov for help with programming. Figures 2; references 7.

#### Using Signals With Parallel Differential Phase Shift Keying in Communication Links With Fading and Scattering

927K0321F Moscow *RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 37 No 5, May 92* pp 938-941

[Article by V.A. Grishin, M.I. Lukhanin, O.V. Radov; UDC 621.391.01]



[Abstract] The time-selective fading of signals transmitted at low rates observed in communication links with multipath radio wave propagation, whereby consecutive messages become noncorrelated, and the low efficiency of using signals with differential phase shift keying (OFM) as the most noise immune in noncoherent detection due to the fact that the preceding signal cannot be used as a reference signal are discussed and an attempt is made to show that the above problem can be resolved by using signals with the so-called parallel differential phase shift keying whereby the information

about the transmitted signal is contained in the initial phase difference of two parallel-radiated oscillations each of which can be used on the receiving end as the reference signal. The parallel phase shift keying signal structure and a block diagram of a parallel phase shift keying signal demodulator containing a frequency synthesizer, a frequency standard, and a decision device are plotted. No additional distortions appear during the correlation processing of the two-frequency signals. A universal formula is derived for assessing the detection noise immunity of the two-frequency signal. Figures 2; references 4.

### **Development and Promotion of Automated Systems at the Time of Transition to the Market Economy**

927K0353A Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 2-5

[Article by L. Kasperova]

[Abstract] An interview was held with the Chief of the Design and Construction Office of the Automated System for Control of Railroad Transport, Aleksandr Pavlovich Pisarev. The topics of discussion concerned the economic problems of the Design Office and prospects for its future activity. The situation existing in many areas of railroad operations was also discussed. It was pointed out that during the recent years different electronic systems had been designed and are promoted for the organization of shipments. In the opinion of A. P. Pisarev the introduction of these systems in the railroad operations requires a complex approach from the point of view of maximum automation of all processes of organization, documentation and control of shipments. Technologically sound elements of the system must be developed from the very start; we must begin with a gradual development of the technical structure, and training of the personnel, which lags behind on many railroad lines of the country. Financial means and facilities are needed for the solution of numerous problems. New economically advantageous forms of international cooperation must be developed. Transfer of the railroad management to stockholder companies would promote an efficient operation of the railroad industry.

### **Digital System for Engineering and General Services Telephone Communications**

927K0353B Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 6-9

[Article by A. K. Lebedinskiy, A. A. Pavlovskiy; UDC 656.254.16:621.395]

[Abstract] The telephone communications for engineering and general services on the railroad transport are traditionally carried out separately by different channels and different communication systems. The efficiency of these channels' utilization can be significantly increased by unifying the channels in a common line connected to the communications units. The advantages of this approach would be obtained by spreading the telephone loads of the services which have nonconcurrent peak hours, and also because the common line will be large enough to warrant better maintenance. The contemporary digital and quasi-electronic automatic telephone exchange can be used for organization of the engineering communication. An algorithm for a digital communication system application on railroads was developed. The digital communication system will make it possible to combine the general service and the engineering communications without the use of special equipment. The

efficiency of this system is primarily determined by the reduced cost of the communication line. The cost of the stations' equipment will also be smaller.

### **Inductive Transceiver for a Remote Control of Railroad Switches from Locomotives**

927K0353C Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 10-12

[Article by A. S. Gordeyev, A. K. Tabunshchikov, N. A. Tsibulya; UDC 656.7:621.397.13]

[Abstract] Transceivers are used for a remote control of railroad switches from locomotives. The block diagrams and circuit diagrams of a locomotive transmitter and receiver are provided in this article. The transmitter incorporates a 12 kHz signal generator, the signal generator control unit, a power amplifier, an antenna, a power supply filter and a unit for indication of the device readiness for operation. The receiver consists of a high frequency filter, three identical band-pass filters, a limiter, a threshold amplifier, and an input signal detector. The transducer functioning is described.

### **Teletype Model F-2000**

927K0353D Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 12-13

[Article by V. A. Kudryashov, M. A. Rakk; UDC 656.254.145]

[Abstract] The model F-2000 teletype can operate in the following modes: in the initial mode of operational readiness, in a programmed mode, in a local operations mode with or without interruption by incoming calls, in a linear mode, with a remote activation of instruments, and in a mixed mode of operation. The features of the teletype operation in these modes are described. When beginning the operations, the operator must formulate the expected services and select the appropriate mode of operation.

### **Expert Systems for Railroad Automatic and Remote Control**

927K0353E Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 13-16

[Article by B. V. Sapozhnikov, M. N. Vasilenko, V. P. Bykov, N. I. Rubinshteyn; UDC 656.25]

[Abstract] Application of expert systems (ES) can significantly contribute toward scientific and engineering progress on railroads. Estimates of the impact that various factors make on the quality of railroad automation and telemechanics (RAT) systems during their development, design and construction constitute the main

objective of the ES expertise. The principles of construction and application of a ES, developed in the "AT-Expert" for complex estimates of the efficiency of the RAT systems operating with automated engineering structures on railroad stations, sections of the railroad lines, and gravity humps, are examined in this paper. The objective of this ES is a complex estimate of the totality of the indicators of safety, productivity, accuracy of control, and power-consumption. The structure of these indicators is shown in a table. For the solution of this problem, the ES synthesizes all fundamental available information on the technology, using a computer program. The two most frequently used algorithms for the RAT analysis are described: an algorithm for the control of functional completeness of the RAT diagrams, and an algorithm for the complex inspection of the RAT safety. Figures 7.

#### **To Improve the Functional Efficiency of Systems Supplying Power to the Electrical Centralization Devices**

927K0353F Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 20-22

[Article by V. M. Vagin, Yu. N. Kuvakin, V. F. Ushakov;  
UDC 621.321:621.311:656.257-83]

[Abstract] The feasibility is examined of increasing the power factor of systems supplying power to the railroad automation, remote control and communication devices. Measurements and computations of this factor on several power stations indicate that its value is 0.45-0.55, which is considerably below norm. The magnitude of voltages in the three-phase electrical power supply systems on the primaries of the isolation transformers is difficult to change since they are determined by the parameters of the external power system. However, it is possible to equalize the phase voltages on the secondaries by a uniform distribution of loads. The power factor can be increased by compensating the reactive components. Several compensation options were examined for a three-phase power supply system of a large plant. It was shown that a delta-shaped connection of the compensating capacitances directly to the isolation transformer is a most advantageous method. This way a compensation of the reactive power can be achieved, which is by a factor of three greater than when using a star-shaped connection of the capacitors. If the maximum possible reactive power  $Q_1$  that can be supplied by the isolation transformer is greater or equal to the reactive power  $Q$ , a direct connection of the compensating capacitors to the transformer's primary is also possible. In this case up to 95 percent of all consumed reactive power is compensated, and the power factor can be increased to 0.95-0.98. The disadvantage of this compensation method lies in that the active and reactive losses in the transformer can not be reduced. For  $Q_1 < Q$ , the compensating capacitors can be connected directly to

the transformer's secondary winding, which would compensate up to 95 percent of the reactive power consumed by the electrical centralization devices. Figures 4, tables 2.

#### **Microcomputer BK-08 "Orel" for Automation of the Railroad Devices**

927K0353G Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 92  
pp 35-37

[Article by V. N. Kapliy]

[Abstract] The microcomputer BK-08 "Orel" was developed and constructed at the "Pridneprovsk" railroad for application with the railroad automatic control systems (RACS). This microcomputer can be used as an intellectual terminal for transmitting data as well as a programmable microprocessor controller of the railroad automatic devices. The BK-08 "Orel" microcomputer is a single board device with an 8 digit capacity. A Z80A type LSIC was used for the central processor. Capacity of the main memory is 65 Kbytes and the ROM is 32 Kbytes. Algorithms for application with the RACS are being developed. Based on the "Orel" microprocessor, a system for coded control of a small railroad station and an "intellectual" telegraph terminal was developed by the specialists at "Pridneprovsk" the Design Bureau. Both devices are now going through an operational testing. A computer aided design system of electronic devices was also developed at the Design Bureau. It includes hardware and software for computer processing of electronic circuits.

#### **Statute of Russian Federation's Railways Ministry**

927K0332A Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 2-5

[Article by Russian Federation Government]

[Abstract] The statute of the Russian Federation Railways Ministry adopted by Russian Federation Government decree No. 20 of 31 March 1992 is reprinted in full. In addition to the statement of purpose and the general guidelines and premises, the new law defines the principal tasks and functions in the fields of traffic management; market research, economics, finance, and accounting; policies and procedures; logistics and procurement; external relations; and personnel, labor relations, and social benefits. The organizational structure of the ministry is outlined.

#### **Service Radio Communication Networks With Radiating Cable in Kharkov Subway**

927K0332B Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 6-8

[Article by A.V. Yelizarenko, N.P. Knyshev, M.I. Moskalenko, N.F. Shvachka, O.F. Demchenko, V.S. Serebryakov]



[Abstract] Service radio communication between train crews and the train dispatchers used in subway systems in many CIS cities in the hectometer wave and, i.e., at 2,444 and 2,464 kHz frequencies, with the help of single- and two-wire lines and the shortcomings of this system, particularly its limited functional capabilities and low operating reliability, prompted the engineers and experts to develop new train radio communication specifications. A new mobile radio communication system used for linking train crews to central dispatchers in the Kharkov subway system which meets these specifications is described and its circuit and block diagrams are cited. The system operates mostly in the decimeter (330 MHz) and meter (160 MHz) wave bands although the hectometer band can still be used. It is characterized by a lower wiring and cable laying cost since there is no need to use repeaters in tunnels and the possibility of bringing it on stream stage by stage. The specific operating procedures for using the new system are outlined in detail. The principal element of the system is a wide-band directional radiating system on the basis of a coaxial cable, usually domestically made RI-50-17-31. TV devices can be connected to the cable if necessary. Figures 2.

#### Microprocessor-Based All-Electric Interlocking Technical Diagnostic System for Large Station

927K0332C Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 8-14

[Article by Ye.A. Korablev, V.K. Dontsov, Urals Electromechanical Institute of Railroad Transport; UDC 656.257-83:681.325.5-181.4]

[Abstract] A new all-electric interlocking technical diagnostic system developed at the Urals Electromechanical Institute of Railroad Transport Engineers (UrEMIIT) which monitors the parameters which vary within a wide range during operation and greatly affect the all-electric interlocking reliability, such as track relay and track transformer voltage, power supply source voltage, and cable insulation resistance as well as double-rail track circuit phase, is described; the system may be used intermittently for measuring the drop-out delay time of train signaling relays. A block diagram of this microprocessor-controlled system, a relay winding connection diagram, a microprocessor input/output block diagram, and specific parameter measurement circuits are cited. The microprocessor is based on a single-chip KR580IK80A integrated circuit. The system can operate in a standby mode as well as in an accelerated, cyclical, and data output modes. In 1985, the diagnostic system was implemented at the Surgut station; in 1990, it was upgraded to increase the number of monitored points from 200 to 400 and transfer data to a station dispatcher microcomputer (PEVM). A similar system operates at the Veynovka station in Sverdlovsk oblast. Figures 12.

#### On Correlation of Concepts of Reliability and Safety

927K0332D Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 18-20

[Article by V.V. Sapozhnikov, V.I. Sapozhnikov, V.I. Talalayev, D.V. Gavzov, D.S. Markov, PIIT; UDC 656.2.08:621.3.019.3]

[Abstract] The definition and correlation of the concepts of reliability and safety is reviewed on the basis of published sources and for convenience's sake, instead of the safe traffic probability (which is close to unity), the concept of traffic safety condition violation probability, i.e., the accident rate, is used. The traffic control devices which may become potential sources of accidents are identified. Of these, the most important are the railroad equipment automation and remote control systems (SZhAT) whose safety, in the end, determines the reliability and safety of the railroad as a whole. For illustration, the process of SZhAT malfunction and the resulting failures is considered in detail. A block diagram of likely consequences of SZhAT failures and a block diagram of the relationship between the railroad transport system reliability and its component elements, such as failure-free operation, safety, durability, and maintainability and their effect on the passenger, cargo, and equipment safety and environmental impact are cited. It is demonstrated that the reliability and safety of individual transport system elements, including the passengers, is part and parcel of the overall railroad transport complex (TK) safety which, according to GOST 27.002, is equivalent to the railroad transport complex reliability. Figures 4; references 7.

#### Increasing Operating Reliability of 25 Hz Track Circuits

927K0332E Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 21-22

[Article by Yu.A. Kravtsov, Yu.I. Zenkovich, B. Kaleta, L.V. Mukhin, Moscow Railroad Transport Engineers Institute and Czechoslovak Transport School; UDC 656.259.12:621.3.019.3]

[Abstract] The operating experience and advantages of low-frequency (25 Hz) track circuits receiving power supply from PCh 50/25 static converters, especially the stability of their output voltage and its automatic shut-off in the case of a brief short circuit and reconnection when the fault disappears, prompted a detailed examination of the design and operating principles of such communication systems. A block diagram of the power supply system and circuit diagrams of single- and double-rail track circuits are cited and their basic specifications are summarized. The system has an enhanced reliability due to a special design developed at the Czechoslovak Transport School; it prevents a group of track circuits from failing when one power transformer

in a single control arm fails. The system has been approved by the Chief Automation and Signaling Department of the Railways Ministry for operational tests in the Gorkiy Railroad. Figures 3; tables 1.

**Discrete Voltage Indicator and Outlook for its Use in Phase-Sensitive Track Circuits**

927K0332F Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 26-27

[Article by M.A. Gotsadze, Z.V. Abuseridze, Georgian Engineering University and All-Union Railroad Engineers Correspondence School]

[Abstract] The importance of reliable and safe operation of track circuits—the principal element of all modern automation and remote control systems which serves as a data transmitter and communication channel—for ensuring traffic safety and increasing the railroad capacity prompted an attempt to develop a track circuit (RTs) with a track relay voltage level monitoring device capable of forewarning the service staff about an impending track circuit failure. The new track circuit employs a digital voltage indicator (DIN); a block diagram of the track circuit and the electric circuit diagram of the digital voltage indicator are cited and the voltage indicator specifications are listed. The design and operating principle of the track circuit with a digital voltage indicator are described; the DIN is characterized by small overall dimensions, the use of a single kit for several relays, a plug-and-socket connection to the rack, the use of a modern component base, a simple design, convenience in service, low implementation outlays, and operating efficiency. Preliminary estimates show that the DIN connection parallel to the track circuit does not affect its operation. The digital voltage indicator has been approved and recommended for use, especially at stations with self-contained and DC electric traction. Figures 2; tables 1.

**Subway Telephone Communication System Design**

927K0332G Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 27-28

[Article by V.A. Prokofyeva, V.V. Baranova, Moscow Railroad Transport Engineers Institute; UDC 656.254.15:625.42]

[Abstract] A four-digit internal service communication system operating in the Moscow subway system is discussed. The system is characterized by an unacceptable length of subscriber loops reaching 15-20 km from the switching exchanges, resulting in excessive line attenuation. Moreover, obsolete stepping switch equipment is used. The need for a radical overhaul of the Moscow subway telephone network is stressed; it would involve replacing obsolete switching equipment and reorganizing the user network on the basis of digital communication

systems. The network cost is used as the optimization criterion. The advantages and shortcomings of designing the user network with a 16, 32, 48, 64, and 128 number concentrator capacity are discussed and it is shown that the cost of line plant and remote equipment volume affect the capacity selection. The optimum capacity depends on the specific switching equipment used and the degree of its matching with the digital transmission systems (TsSP) and fall within the 32-64 number range. It is noted that today, the DX-210 switching equipment made by Nokia (Finland) and a Kvant digital automatic telephone exchange made by VEF (Latvia) are the most accessible yet the DX-210 system meets the Moscow subway system requirements more fully. It is stressed that this analysis can also be applied to other subway systems.

**Solid State Microwave Elements Used in Railroad Transport Radio Systems**

927K0332H Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 31-36

[Article by O.I. Shelukhin, V.M. Artyushenko; UDC 656.254.16:621.3.029.6:656.212.5]

[Abstract] The increasing uses of microwave (SVCh) solid state elements, especially in radio relay links (RRL) operating in the 8-11 GHz band, prompted an attempt to familiarize the readers with the operating principles, basic parameters, and design and operation characteristics of microwave oscillators, modulators, and power supplies which are little known to many engineers and technicians. In particular, the general characteristics of solid state microwave oscillators, particularly avalanche transit time (GLPD) and Gunn diode (GDG) oscillators and their frequency response and solid state microwave oscillator-based resonator systems, e.g., resonant cavities are examined; such solid state microwave oscillator parameters as service band, output power and its variations within the service band, and frequency tuning band and retuning speed are considered in detail. The solid state microwave oscillator design, modulation principles, and power supply sources are examined and the microwave technology development outlook is assessed. The high cost and low reliability which constrain the microwave technology applications are noted. Figures 10; tables 7.

**Communications Construction Workers Bank on Commercial Structures**

927K0332I Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ in Russian No 7, Jul 92  
pp 37-38

[Article by D.P. Marchukov]

[Abstract] The effect of the transition to a market economy and the freeing of prices on the established

notions of funds, allocation, assignment, and distribution and the emergence of new economic concepts, e.g., barter, in the communication system construction industry—especially hard hit by the reforms—is discussed. The principal causes of this industry's hardship are analyzed. It is shown that the construction cycle starts with producing ore and rock raw materials and making metal and building materials and paying taxes along the way, then procuring erection and construction work; the second cause is the fact that funds are invested in construction only after payroll and other expenses have been met, rather than when needed. The need to reevaluate the investment strategy is recognized and it is noted that one of the first commercial structures in the field, the STS-Servis enterprise, is aimed at diagnostics and reconditioning of existing cable lines because outlays for these functions are low compared to new construction, especially since the cables and cable plant can be reconditioned gradually. The capabilities and practices of the STS-Servis enterprise are reviewed and it is speculated that in the future, the company will remain competitive.

#### Teletype Model F-2000

927K0331A Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92 pp 4-6

[Article by V. A. Kudryashov, professor of "Electrical Communications" department of PIIT, M. A. Rakk, engineer; UDC 656.254.145]

[Abstract] First generation teletype models F-1100, RTA-80 and the second generation model F-2000 are used in the Railroad Ministry telegraph communication system network along with the electromechanical telegraphs. The functioning of the teletype F-2000 is described. The teletype construction is based on conceptually new microprocessor principles. The teletype can interact with all types of electromechanical and electronic apparatuses and communication stations. The microprocessor element base makes it possible to employ a large number of algorithms for control and processing of digital signals, to change the function of any device without changing its composition and circuit by only changing the program in the microprocessor memory. The modular construction of the apparatus and employment of a microcomputer significantly expands the technical range of the device operating characteristics. A block diagram of the F-2000 teletype is provided. It includes the following units and modules: the central control unit, the interface module, the external devices and the power supply unit. Figures 3.

#### Engineering Resources for the Railroad Gravity Yard Automation

927K0331B Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92 pp 7-8

[Article by I. S. Kats, senior engineer of the "Giprotrans-signalsvyaz" Institute, I. I. Prudovskiy, Department Head, F. A. Solovyev, senior engineer; UDC 656.254.145]

[Abstract] Recently, the specialists of the "Giprotrans-signalsvyaz" Institute have developed the following technical resources for railroad marshal yards; apparatus for regulation of the speed of railroad cars uncoupling, and apparatus for monitoring the railroad occupancy of the marshaling yards. This equipment is employed with automated systems for controlling the process of maneuvering the trains on the sorting humps and is also used for mechanization of the brake action. The apparatus consist of several units. The functioning and the composition of the units is described. In order to provide for an independent operation of the track occupancy controlling apparatus, development in the near future is contemplated of a device for a visual indication of the tracks occupancy. This device will be equipped with digital indicators, where a three-digit number will be displayed indicating the length of free track in meters, or a two-digit number indicating how many free track section are available. The analog indication is also possible in a form of a lighted bar. Figures 3.

#### Algorithm for Diagnostics of Malfunctions of Railroad Switches

927K0331C Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92 pp 9-11

[Article by M. M. Aliyev, (Head of the "Computers Technology, Mathematical Methods of Planning and Control" Department of Tashkent Institute of Railroad Engineers, Candidate of Technical Sciences), O. A. Lesina, (assistant), G. M. Khadzhimatova, (senior scientist of the Uzbek Republic Academy of Sciences UZNP "Cybernetics", Candidate of Technical Sciences)]

[Abstract] In order to provide reliable and stable maintenance of the centralized switches on railroads a diagnostic system of the switches' conditions was developed. The algorithm, proposed in this paper, is a combination of the ideas of the information method of technical diagnostics and application of contemporary computers. With this diagnostic system it is possible to store a large volume of information and to retrieve expeditiously the required information on malfunctions. A block diagram is provided in this paper of the algorithm for diagnostics of breakdown of elements of the centralized switches with a two-wire system for controlling the electric drive of the switches. This algorithm uses indications from an ampere meter, ringing of a bell, control light of the switches' position and from a device indicating the state of the circuit breakers and power lines. Based on these indications the analysis is made of the malfunctions and their location is determined. With this algorithm the reliability and accuracy of diagnostics would be greatly improved and time required for location of the problems reduced. Figures 4.



**Apparatus for Statistical Multiplexing of Communications Channels With Pulse Code Modulation**

927K0331D Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92  
pp 13-14

[Article by G. V. Gorelov, (Head of Moscow Institute of Railroad Engineers "Radio Engineering and Electrical-Communications" Department, Professor, Doctor of Technical Sciences), A. V. Ivanov, (Associate Professor), O. N. Lukova, (teacher); UDC 654.147.2/8]

[Abstract] The number of communication channels can be doubled without additional capital investments using various devices for statistical multiplexing of the primary digital transmission systems. A system is examined in this paper, which makes it possible to combine two sets of analog-digital equipment. With the described statistical multiplexing the information transmission quality of one of the sets deteriorates compared to the conditions of the standard primary digital transmission system. Unfortunately, this is the price for doubling the number of channels. However, the experiments indicate that in most cases the quality of transmission remains satisfactory. For example, when the signal was described by a stationary, centralized process with a hyperexponential one-dimensional distribution density of instantaneous values and by an exponentially cosinusoidal correlation function, the following values of the quality were obtained for the standard primary digital transmission system: the ratio of the signal power to the power of the sampling noise - 39 dB, the ratio of the signal power to the power of equivalent, from the clients point of view, stationary noise - 76 dB, and the value of syllable legibility - 93 percent. Figures 2.

**Technical Documentation for Signalling, Centralization and Blocking System. Maintenance Problems and Prospects.**

927K0331E Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92  
pp 23-27

[Article by G. N. Karpova]

[Abstract] Quality of the technical documentation of designs and their accurate implementation is very important for providing uninterrupted functioning of signaling, centralization and blocking devices. Gross violations, waste and accidents occur when the technical documentation is disregarded and when the design changes are analyzed inaccurately. This problem was the subject of a seminar held at the Rostov-Central station of the North-Caucasian Railroad. Thirty-seven representatives of different railroads discussed their experience and expressed their view on the matter. The participants of the seminar were united in their opinion that many violations occur because of a low appreciation of the activity of the technical documentation personnel by the management. Cases were cited at the seminar when a

project documentation was completed many years ago, but no additional decisions and technical recommendations were supplied to this day. It was requested that some paragraphs of the Instruction on technical documentation would be reviewed, and that no deviations from following the Instruction would be tolerated.

**Reasons for Insufficient Efficiency of Solar-Ray Protection Shields**

927K0331F Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92  
pp 28-29

[Article by N. V. Byzov, Yu. A. Kovalskiy, N. N. Lyakhov]

[Abstract] Even though the effect of solar radiation on the performance of the PONAB equipment has been discussed for along time, no final solution of this problem is in sight. The previously recommended method for protection of bolometers from the unfavorable effect of solar radiation by shading shields was implemented at the Irkutsk-Passenger section of the Irkutsk branch of the East-Siberian railroad line. However, the expected results were not realized. In this paper a more simple method, than the one described in earlier published works, is examined for computations of the days and time of the solar effect. The duration of the sun's interference is determined from the condition of its uniform motion along the diurnal parallel. It was shown that the limits of the solar effect on the right chamber lie between 7 April and 7 May, or, respectively, between 5 August and 5 September. For the left side chamber it is between 12 March and 7 April, or 5 September and 1 October. It was computed that the beginning time of the solar irradiation of the right chamber is between 9:28 and 10:08 and for the left chamber is between 10:45 and 11:25 on 21 April, when the effect is greatest. For experimental purposes the solar ray shields were installed by following the Railroad Ministry recommendations for protection of the bolometer, but the efficiency of this device was not high. False signals were produced during the periods stated above. Apparently, the extremely high intensity of the solar radiation compared to the radiation of the heated journal box was the cause of the solar interference. This indicates that the solar protection shields do not guarantee the bolometer's protection. A more effective protection method must be found. Figures 3.

**Mechanization of Construction, Maintenance, and Technical Service of Communication Lines**

927K0331G Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 4, Apr 92  
pp 37-40

[Article by Z. Ye. Lomovitskaya]

[Abstract] This paper contains a review of the development of air, cable and radio relay lines for the railroad

communication lines in foreign countries. Most labor-intensive and expensive to maintain are the air communication lines. Cable lines are used for railroad communication in Germany, Japan and France. The radio relay lines are developed specifically for the railroads in the USA, Canada and Japan. Fiber optic communication lines are being installed on new and reconstructed sections of railroads. Methods and technology employed for construction of the communication lines in Great Britain, Canada, Japan and the USA are discussed with particular attention to the construction of the fiber optical communication lines. It is pointed out that a great experience is accumulated abroad in the employment of contemporary technology, in the construction and assembly of the fiber optic communication lines. The particular features of laying the optical cables are determined by its great construction length, which can extend several hundred meters. With these lengths the conventional cable laying methods are unsuitable. It became necessary to perfect the technology and the engineering equipment. The technology of assembling the fiber optic cable employed with German railroads is well developed and is successfully tried with many fiber optic communication lines of the German Post Department.

#### **Safety of Train-Traffic with Reliable Operation of the Signalization, Centralization and Blocking System**

927K0330A Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 5,  
May 92 pp 2-6

[Article by M. S. Podgaychenko]

[Abstract] Occurrences of accidents and safety violations in the railroad transport industry remain high. One of the main reasons for accidents is the low level of industrial and technical discipline of the personnel in some branches of the service. The performance analysis of signalization, centralization and blocking (SCB) devices indicates that the situation somewhat improved in 1991. During the period between 1987 and 1989 the number of the equipment malfunctions was 22-25 percent of all failures of the signalization and communications equipment. In 1990-1991 this figure was reduced to 11.44 percent. A review is made in this paper of the equipment malfunctions and accidents which occurred during the recent time on various railroads of the country, and the measures needed for their elimination are discussed. Inspections which were conducted at several railroads revealed that the managers of the service branches and sections do not pay much attention to the content of the engineering documentation. Directions of the Railroad Chief, and recommendations of the GTSS dealing with changes in technical documentation for elimination of shortcomings uncovered during the railroad operations are not followed because at many railroads there are no control systems for checking the execution of these directions and recommendations. Figures 1, tables 2.

#### **Electromagnetic Compatibility of Train Radio-Communication Devices with the AC Power System of the Electric Train Line**

927K0330B Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 5,  
May 92 pp 7-10

[Article by A. V. Naumov, A. B. Kosarev]

[Abstract] On many electrified railroads the waveguides of radio-communication system along the train tracks are normally separated into sections by capacitors and shunting lightning arresters with each section connected to the middle-point of the track choke-transformers through a 750 Ohm resistor. Frequently, the devices of the train communication fail, mainly because of electrical storms during the spring and summer months. After conducting the electromagnetic compatibility studies it was proposed that in order to solve this problem the waveguides sections must be grounded individually through radio-frequency chokes. The most attractive feature of this scheme is that it eliminates the need for the section-separating capacitors, lightning arresters and resistors, while the incorporation of the additional chokes into the grounding circuit reduces its reliability. It is important to properly select the length of the waveguide sections and not to ground the sections to the railroad rails, but to use individual grounding stakes. The suspension of the waveguide on the high voltage power line supports must be carried out by carefully following the appropriate regulations. Figures 6.

#### **Concept of the Communication and Satellite Navigation System for a High-Speed Main-Line Railroad**

927K0330C Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 5,  
May 92 pp 13-14

[Article by Yu. A. Yerokhin, A. Yu. Yerokhin; UDC  
629.78:656.25.022.846]

[Abstract] In addition to the satellite-controlled communication system, a radio-navigation system must be included in the arsenal of technical facilities for controlling the train traffic on high-speed arteries. The purpose of such system lies in measuring the parameters of the trains' movements, their location, speed etc., to achieve a reserve control mechanism of the train traffic. The main condition for the system implementation includes the necessity of installing the equipment on 277 trains, while 150 of them may be moving at the same time. A method was developed for justification of the train traffic parameters measurements in terms of accuracy and reliability. The radio-navigation methods can produce high-quality measurements. However, the authors of this paper believe that for this situation more balanced requirements between the main and the reserve control mechanisms are more suitable. The balanced requirements will provide more stable control and will increase the reliability of the entire control system. Thus,

a redundancy will be provided for measuring the trains progress with a high probability of trouble-free operation of the system. The experience of foreign countries' employment of satellites for controlling the railroad traffic is reviewed, and it is concluded that these systems exhibit some advantages and disadvantages. Figure 2, Table 1.

**Control and Signal Device of the ALSN  
Wagon-Laboratory Measuring Apparatuses.**

927K0330D Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 5,  
May 92 pp 17-20

[Article by A. P. Kirikashvili, O. N. Denisenko; UDC  
629.464.247:621.317.3]

[Abstract] The wagon-laboratories ALSN is used for measuring the parameters of coded signals and for comparing their adherence to the established standards. Deviations from the standards can be recorded during the wagon motion by visual observation of the instruments, as well as during the data processing. Errors can be made with the visual observations, and it takes a relatively long time for the tape records to reach the user. Because of these considerations a controlling and signaling device (CSD) for a continuous and immediate comparison of the measured parameters with the norms was developed and manufactured by the specialists of the South-East Railroad laboratory. This device can control the following parameters: The code currents below 1.4 A and greater than 5.0 A at the input end of the rail circuit and the code current along the entire length of the rail circuit with currents above 18 A; the initial code interval below

0.1 sec. and above 0.19 sec; relative asymmetry of the AC greater than 40 percent etc. The device operation is described, and block diagrams of the circuits are included. Application of the device with the wagon-laboratory operations increases the efficiency of obtaining the data of deviations of the measured parameters from the norms. Figures 4.

**Distributed Information Processing Network on  
the Railroad**

927K0330E Moscow AVTOMATIKA,  
TELEMEKHANIKA I SVYAZ, in Russian No 5,  
May 92 pp 28-30

[Article by A. V. Kirsanov, E. V. Tuchkov; UDC  
658.011.56:656.2]

[Abstract] A network of automated working stations for processing the operational information directly at places of its origin is being developed at the North-Caucasian railroad. The main concept of this system is integration of the information. The information produced at any working station when processing a document is forwarded to the higher management level in a prescribed format. All types of lower level accounting are made locally. The redundant information is not forwarded to the higher level, but the information that entered the computer from any working station is readily available to every client of the network whose access to the network is authorized. The development of the distributed information processing network is carried out along four major directions. It includes automation of operational accounting, automation of operational control of shipments, the data processing of the train routes, and automation of the bookkeeping and financial operations.



**Non-Programmable Problems and the Technology for their Solution**

927K0357A Moscow *PRIBORY I SISTEMY UPRAVLENIYA* in Russian No 6, Jun 92 pp 2-4

[Article by V. I. Franchuk; UDC 331.102.1.001.1]

[Abstract] Problems that can not be solved by employing complex goal-oriented programs and which require a development of special control systems, or organization systems (OS), are called non-programmable. The proposed approach to the solution of the non-programmable problems is guided by the following considerations: 1. The complex socially significant problems, (economic, technical, scientific, etc.), are solved by employing the OS. 2. The developed OS depend on the particular features of the problems that are to be solved. 3. The programmable problems are solved by the goal-oriented OS. 4. The non-programmable problems are normally solved by the regular OS. 5. Methods of constructing a management system of the goal-oriented complex problems can be used for development of the programmable goal-oriented OS. 6. A problem-oriented approach can be used for the development of the regular OS. In much the same way as with the management information system, the process of developing the problem oriented OS is carried out in three stages, which include a preliminary stage of scientific research (SR) and development of engineering and economic justifications (EEJ); preparation of the engineering and work specifications (EWS); and the stage of making the OS operational, consisting of installation, testing operation and inspections. Alternative ways for constructing the OS are formulated during the EEJ stage, and the project solutions on the OS structure, composition of the problems, the systems' functions and documentation are worked out at the EWS stage. In addition to development of new OS, the proposed method can have at least one other practical application: it can be used for optimization of the existing OS. By employing this method the utilization efficiency of the national resources can be increased. References 10: 9 Russian, 1 Western.

**Composition of a New Generation Programmable Controller**

927K0357B Moscow *PRIBORY I SISTEMY UPRAVLENIYA* in Russian No 6, Jun 92 pp 7-10

[Article by V. L. Sosonkin, V. L. Potaskuyev; UDC 658.52.011.56.012.3:681.3]

[Abstract] The architecture is described of a programmable controller (PC) for application with a personal computer operating in the "on line" mode. An expanded set of functions, which determines the belonging of the controller to the new generation of systems for controlling the cyclic automatic processes is examined, and the composition and purpose of the resident software for new generation controllers is analyzed. In addition to a progressive architecture, a powerful instrumental support for development of control programs and graphic

information models, reflecting the behavior of the object of control, constitute the most significant features of the new generation programmable controller. Figures 7, references 2 Russian.

**Information Display System for a Process Control Computer Complex SM 1800**

927K0357C Moscow *PRIBORY I SISTEMY UPRAVLENIYA* in Russian No 6, Jun 92 pp 10-11

[Article by Yu. V. Nifontov, V. V. Kalita, G. M. Bobkov; UDC 681.327]

[Abstract] The information display for the process control computer complex (PCCC) of the SM-1800 type are discussed. The SM 1800 is a currently developing system. In 1980 an 8-bit PCCC was developed, followed by a 16-bit modification, and presently a 32-bit machine is being developed. A functional unit concept is used in the construction of the SM 1800. All units are interconnected by a standard interface. The SM 1800 contains several modules: processors, memory modules, network and interface modules, information display modules, etc. The automated manufacturing control system is the major area of the PCCC application. Because the SM 1800 is equipped with several video controllers, many models can be used as working stations for the computer aided design. The characteristics and features of the video controllers that are used with the SM 1800 are described. The controllers are compatible with the foreign made controllers. Several software packages for the SM 1800 operation with the PCCC, as well as a basic software for the information display were developed. Figures 2, references 3 Russian.

**Non-Standard Equipment for Calibration and Testing of Sensors**

927K0357D Moscow *PRIBORY I SISTEMY UPRAVLENIYA* in Russian No 6, Jun 92 pp 19-20

[Article by K. Ye. Balashov; UDC 685.586.002.5]

[Abstract] The State controlled system of uniform measurements requires the determination of metrological characteristics of instruments, such as fundamental error, exposure to external effects, additional errors, etc. Several types of non-standard instruments for calibration and testing of sensors, which measure the pressure and displacements, are examined and their function is described. Reconstruction and transfer of the values of different external effects to the tested sensors, not reproducible by a standard test equipment, can be made with these instruments. The examined instruments include: the inertial pulsers, which are devices for reconstruction of a varying pressure, intended for calibration of piezosensors; direct contact making or contactless devices for calibration of inductive or potentiometer type sensors of linear displacements, and the vibrations amplifiers.

### Development of New Designs and Application of Magneto-Sensitive Hall Sensors

927K0357E Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 6, Jun 92 pp 22-25

[Article by G. Ya. Portnoy, O. A. Postnykh; UDC 621.382.61.004.14]

[Abstract] The Hall sensors are most popular semiconductor devices among other magnetosensitive elements. A short review is made of the state-of-the-art. Beginning with 1961, more than 20 types of discrete Hall sensors based on germanium and silicon, as well as on epitaxial semiconductor layers, were developed in the All-Union Scientific Research Institute of Electromechanics. Fundamental technical characteristics of a Hall sensor developed in this institute and available for sale are provided. The Hall sensor is based on a heteroepitaxial n-InSb-i-GaAs structure. A thin layer of Indium antimonide is epitaxially grown on a semi-isolating substrate of GaAs. Different approaches for construction of the Hall sensors are described. A continued increase in demand for the Hall sensors, which in the near future will reach 3-4 million annually is predicted. The major criterion for these devices will be their low cost and reliability. Figures 3, references: 9 Russian, 1 Western.

### Programmed Numerically Controlled Device "Mayak-62"

927K0357F Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 6, Jun 92 pp 27-28

[Article by R. F. Urakov, V. S. Pleshkov, I. L. Velichanskiy, S. Kh. Badash; UDC 621.9.06-229-529]

[Abstract] Fundamental technical characteristics are listed, and the hardware structure, including the functional software capacities of the numerically controlled device "Mayak-62" are described. This device was developed in the Izhevsk Scientific Research and Technology Institute "Progress" for servicing multi-coordinate milling and drilling machines, and also for laser technology complexes. In addition to the standard functions, the "Mayak-62" is capable of performing a mirror-like processing and rotation of the axis by any angle, an automatic selection of the cutting mode for a typical operation, control of the spindle in the tracking mode, etc. Mass production of the "Mayak-62" started in 1990.

### Device for Multiplication and Division of Codes

927K0357G Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 6, Jun 92 pp 28

[Article by V. N. Abozin; UDC 681.327]

[Abstract] A device is described for multiplication and division of codes using the consecutive approximations method. An 8-digit multiplier - divider was constructed

based on this method. Transistor-transistor logic elements and the transistor - transistor logic Schottkey technology was used for the construction. The multipliers use the read only memory (eight K556RT4 and five adders K555IM6). If special K1802VR3 microcircuits were used, the hardware cost can be reduced by 40 percent. The computation time for multiplication is not greater than 80 ns and the division time is between 270 and 420 ns. Figure 1, references 2 Russian.

### Device for Interfacing the "Oka-400" Electronic Cash Register Printer With a Personal Computer

927K0357H Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 6, Jun 92 pp 29

[Article by A. A. Zhukov, A. V. Konchits, L. Ye. Bogachenko; UDC 681.327.54.071.1]

[Abstract] Automated systems for selling tickets include a personal computer, a display and a printer. The cash register "Oka-400" is provided with a printer and is suitable for this application. Smolensk Design and Technology Bureau has developed a device for interfacing the "Oka-400" cash register printer with a personal computer. In order to use the "Oka-400" as a computer controlled printer, the processor unit and the main memory must be replaced by the interfacing device. The device is built with a KM18211VM85A microprocessor, and a K537RU8A microcircuit is used as a power supply independent main memory. The interfacing device can perform some service functions. For example, when the ticket tape runs out, or the printer head transport mechanism fails, signals are generated by the processor, which can be identified, and printing stops.

### Organization of Different Sorting Methods in Computer Systems

927K0337A Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 25-28

[Article by V. F. Guzik, V. Ye. Zolotovskiy, S. A. Chinenov, Taganrog Radio-Technical Institute; UDC 681.323]

[Abstract] Organization of the data base and the corresponding systems for controlling the data base (SCDB) are widely used in contemporary computers for solution of different non-numerical problems. Practically all SCDB projects are based on employment of a relational model. Relational algebra executes the fundamental operations. Sorting constitutes the base of almost all of these operations. When designing contemporary efficient SCDBs it is important to be aware of different sorting methods. The most common information sorting methods are examined in terms of their suitability for parallel processing and an universal model of algorithms for information sorting is proposed. With this model it is

possible to utilize different sorting methods that constitute the base of the relational algebra. Figure 4, references 7: 3 Russian, 4 Western.

#### **Application of Equivalent Transformations for Determination of the Parameters of Certain Types of Non-Linear Resistive Three-Terminal Macromodels**

927K0337B Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 33-41

[Article by S. N. Basan, L. A. Zinchenko, Taganrog Radio-Technical Institute; UDC 681.372.0.06]

[Abstract] Equivalent transformations can significantly simplify the modeling problem of an electronic circuit. Application of equivalent transformations is examined in this paper for determination of the parameters of certain types of non-linear resistive three-pole devices. It was demonstrated that the parameters of a complex three-pole macromodel composed of more simple three-pole devices can be determined using the equivalent transformation method. If the simple three-pole devices can be described by multidimensional exponential polynomials, the examined non-linear resistive three-pole will also be described by multidimensional polynomials. The exponent of the approximating polynomial is increased with a cascade method of connections. The computation time can be significantly reduced with application of these methods. Figures 5, references 6 Russian.

#### **Efficiency of the Signature Analysis in the Self-Testing VLSI Circuits**

927K0337C Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 51-56

[Article by V. N. Yarmolik, Ye. P. Kalosha, Minsk Radio-Technical Institute; UDC 621.382:681.14-32]

[Abstract] Reliability problems of signature analysis for design of self-testing VLSI circuits are examined and a method is developed for analytical determination of signatures for application with signature analyzers. Expressions are obtained which determine the necessary condition for signature testability of the faults. It is demonstrated that the reliability of the signature analyzer can not be determined only by its capacity, as would follow from the integral evaluations. A more objective characteristic of the reliability, when designing the self-testing VLSI circuits, is the necessary condition for signature testability. Using this condition the designer can find an optimal, from the test reliability point of view, combination of the generator of pseudo-random test sequences and the signature analyzer. Figures 2, references 6: 4 Russian, 2 Western.

#### **Reduction of the Number of Probes for Diagnosis of Digital Devices**

927K0337D Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 56-62

[Article by D. V. Speranskiy, N. V. Cherevko, Ukrainian Academy of Sciences Institute of Applied Mathematics and Mechanics, Donetsk; UDC 62-50:007.52]

[Abstract] The efficiency of detecting malfunctions during manufacturing end operation of digital devices is significantly enhanced by using a control probe (CP), which is an instrument for indication of the elements' dual state. A method is developed for uncovering the malfunctions in digital devices (DD) with a reduced number of probes, compared to the traditional method, by using the information on the structure of the device. The description of the DD topology and the table of standard values of the digital device's functional elements (FE) serves as the initial diagnostic information for the procedure. A digital device consisting of the memory elements and logical elements with a global feedback is examined for a diagnostic procedure. In order to avoid probing all functional elements, a preliminary separation is made of the DD into several structural units. A structural unit is a collection of interconnected functional elements. The detection of a defective FE is made in two stages. During the first stage the malfunction is localized for a unit, and during the second stage the detection of the FE is made within the unit. Following some requirement with respect to separation of the DD into units it is possible to reduce the number of probes by eliminating them from the units which do not contain faulty FE, but only "transfer" the malfunction effect to the DD outputs. Figures 2, references 5 Russian.

#### **Shock Model With a Maximum Damage in a Class of "Aging" Distributions**

927K0337E Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 62-63

[Article by L. P. Khomenko, Ukrainian Academy of Sciences Cybernetics Institute, Kiev; UDC 519.21]

[Abstract] The widespread interest in the shock models is explained by their suitability for modeling random processes of material fatigue, origination of earthquakes, or cancers. Robust estimates are made in this paper of the probability of a reliable functioning of devices exposed to a series of shocks, assuming that the distribution functions of the model belong to the most important and frequently applied functions in the reliability theory of the ageing criteria. A model is examined, where the device is subjected to shocks from outside, causing a recovery process. The device fails when the damage exceeds a limiting level. Accurate values are determined for a typical case of the reliability theory. References 7: 1 Russian, 6 Western.



### Stochastic Modeling of Radio-Ecological Accidents

927K0337F Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 71-79

[Article by V. B. Georgiyevskiy, A. I. Dvorzhak, Ukrainian Academy of Sciences Institute of Modeling in Power Engineering, Kiev; UDC 614.876]

[Abstract] Dynamic stochastic models are developed for the analysis and prediction of the dose status of humans after exposure to radiation due to ecological accidents. The models are constructed based on the principles of randomly selected determinate dynamic models. These principles are actually reduced to numerical statistical experiments with the models. The following problems must be solved for realization of the model: 1. Construction of dynamic models of the radio-nuclides propagation along ecological and trophic chains. 2. Estimation of the reliability of prediction of the dose status by dynamic models. 3. Estimation of uncertainty of the radio-ecological predictions. 4. Evaluations of the internal inhalation and external irradiation. 5. Modeling of the dose status, taking into account the entire radionuclides spectrum of the contamination. 6. Examination of the stochastic models as a generalization of the determined models. 7. Analysis of the Chernobyl accident. The results of the modeling indicate that the estimates of doses obtained with this model using the initial data published by the United Nations Scientific Committee on the Effects of Atomic Radiation are in a good agreement with these data. Histograms of the dose distribution at the end of the third year after the Chernobyl accident illustrate the extent of the contamination. Figures 6, references 14: 7 Russian, 7 Western.

### A Type of Integral Equations for Computation of Electrostatic Fields

927K0337G Kiev ELEKTRONNOYE  
MODELIROVANIYE in Russian Vol 13, No 3,  
May-Jun 92 pp 88-90

[Article by V. M. Mikhaylov, Kharkov Polytechnical Institute; UDC 537.212:621.319.001+24]

[Abstract] Many electrical devices, for example, screens of high-voltage electrical apparatuses, or the contacts of switches constitute systems of conducting bodies, located near a surface on which different types of boundary conditions can be specified. With arbitrary configuration of the boundary surfaces, the method of integral equations is one of the effective methods for computation of the electrostatic fields. Integral equations of the first kind are obtained for determination of the surface density of conducting electrodes. By applying an appropriate Green function the boundary surface was excluded from the integration region, which made it possible to reduce the order of the system approximating equations, and to simplify the problem. Figures 2, table 1, references 12 Russian.

### Failure-Immune Microprocessor System With Adjustable Structure for Process Automation

927K0335A Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 1-3

[Article by D.D. Rubashkin, Sistema Scientific Production Office of the Elektromash Scientific Production Association, St. Petersburg; UDC 658.51.011.56:62-192.001]

[Abstract] A nontraditional approach to ensuring the failure immunity of control and monitoring systems which is based on the methods of enhancing the reliability characteristics developed for computer systems is presented and an attempt is made to find ways of solving the problems arising when structural design methods of failure immune computer system development are extended to the class of multifunction control systems. The proposed approach is used for process control systems for multiple similar entities. For illustration, the compressor shop is considered and the architectural and algorithmic aspects of the failure-immune system design are investigated. It is suggested that the process control system be divided into two layers for this purpose: one is realized by the principal equipment and represents a set of communication devices with the controlled entity and the entity itself; the other is the microprocessor controllers which realize process algorithms. The algorithms of failure-immune control and monitoring systems for the specific compressor shop applications and the switching network architecture are examined in detail. The proposed method makes it possible to produce both *a priori* reliability estimates and on-line self-check procedures; the method can be realized using today's component base, particularly single-chip computers and serial I/O adapters. The use of Mil and Bitbus interfaces is suggested. The proposed approach has been adopted for exploratory designs and has even been tested in 1988-1990 at various plants. Figures 2; references 4.

### Automated Workstation for Sapfir-91 Computer-Aided Process Control System Hardware Designer

927K0335B Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 7-8

[Article by M.D. Ginzburg, Scientific Research and Design Institute of Computer-Aided Control Systems of Gas Transmission at the Soyuzgazavtomatika Scientific Production Association, Kharkov; UDC 681.3.06]

[Abstract] The shortcomings of an approach to increasing the output of designer work and improving its quality as well as raising the standardization and unification level of the resulting designs by developing and implementing interbranch computer-aided process design hardware prompted the development of a new computer-aided design system (SAPR) which would realize the through CAD principle. To this end, an

automated workstation is developed for the CAD operators of the Sapfir-91 system. In its functional capabilities, the new automated workstations (ARM) developed on the basis of microcomputers (PEVM) differs from earlier integrated CAD systems in that the ARM data bank contains all information necessary for the designer and has well-developed retrieval and decision-making functions. The logic structure of the integrated database is considered and a flow chart of the pipelining design decision-making method is cited. Databases of standard designs are maintained by the designers themselves while information is accumulated during the system operation. The use of the new workstation makes it possible to generate process control system designs for various branches of the national economy within a shorter time, better, and with lower designer time outlays than the traditional unified system (YeS) workstations. Figures 1; references 2.

#### Microcomputer-Based Intelligent Control System Terminals

927K0335C Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 13-15

[Article by J.M. Stoffel; UDC 681.327.1:681.3-181.48:64]

[Abstract] "Industrial CRTs offer higher performance at lower costs", an article by J.M. Stoffel from *Control Engineering* No. 10, 1988, pp. 61-64 is translated from the English by Yu.M. Bonkarev; it addresses the issue of the expanding use of cathode ray tube-based (ELT) display terminals as the man-machine interface in industrial automation systems. The factors which must be taken into account in selecting an intelligent terminals and different approaches used by terminal manufacturers are outlined. The specific features and cost of various intelligent terminals and the resulting soft architecture concepts developed for them are summarized. References: 1 Western.

#### Laser-Based Linear Displacement Meter for Numerical Control Tool Information Feedback

927K0335D Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 19-21

[Article by S.V. Kapezin, V.A. Meshcheryakov, Penza Polytechnic Institute; UDC 534.226:531.715.1]

[Abstract] The designs of interference linear displacement meters with a  $\lambda/128$  measuring step, where  $\lambda$  is the laser wavelength, are considered; the contactless heterodyne acoustooptical interferometer-based meters are intended for supporting the operation of numerical control machine tools (ChPU) with a high degree of accuracy. The optical train design is based on the modular unit principle which makes it possible to develop multi-coordinate systems with varying optical axes positions in the measured displacement space. The high accuracy of the meter or its small quantization step is combined with

the possibility of integrating the heterodyne interferometer with the numerical control system. To be operational, the numerical control system calls for a set of four orthogonally phase-shifted pulses used as the measured input signals. The conversion errors are analyzed and the specifications of a pilot prototype are summarized. The laser meter's principal element is a frequency stabilized LGN-302 laser emitting on a 0.6328  $\mu\text{m}$  wavelength; it also contains an optical emission generator, and an interference transducer. The maximum machine tool carriage displacement rate is 0.24 mm/min; as the reading quantization step increases, the maximum permissible carriage speed can be increased proportionately. The dimensions of a pilot laser meter prototype are cited. Figures 2; references 2.

#### Automatic Building and Structure Foundation Creep Monitoring System

927K0335E Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 22-24

[Article by V.R. Kostanyan, A.S. Meliksetyan, A.G. Pogosyan, A.A. Ter-Khachaturov, Interbranch Advanced Engineer Training Institute, Yerevan; UDC 528.024.1:532.5.013]

[Abstract] The need for periodic monitoring of the state of building and structure foundations in areas with elevated seismicity or permafrost in order to detect on time the emergency situations and take proper measures as well as predict likely foundation sinking and the shortcomings of such hydrodynamic leveling devices as SGDN-10D, SGDN-10DM, and USGDN prompted the development of a system of automatic monitoring of building and structure foundation creep (SAK SF). To this end, a two-level system for automatically monitoring the vertical foundation displacements is developed at the Interbranch Advanced Engineer Training Institute (MIPK). The SAK SF system operating principle is described and its block diagram is cited. An algorithm of the data file interchange procedure is described; the microcomputer statistically processes the input data from the foundations and determines the estimates of the mathematical expectation, variance, and standard deviation of the excess displacement value. The excess measurement range is up to 50,000  $\mu\text{m}$  while the confidence interval at a 0.95 probability is 50-300  $\mu\text{m}$ . The system makes it possible to monitor the displacement behavior and determine the rate of foundation sinking. Figures 3; references 3.

#### Thin Film Capacitive Pressure Pickup With Solid Dielectric

927K0335F Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 24-25

[Article by A.A. Kazaryan, Central Aerohydrodynamic Institute, Zhukovskiy; UDC 681.586.33:681.586.772]

[Abstract] The operating principle of a capacitive pressure gauge developed on the basis of a thin PM-1E polyimide film which serves as the sensor is described. The pickup is made with a solid dielectric either as a single piece, or as a matrix; in the latter case, several sensors are formed on a single thin film substrate whose dimensions and mutual position are selected on the basis of the specific measurement entity configuration and the experiment conditions. A schematic diagram of the pickup design is cited and the capacitance increment as a function of pressure is plotted. The pickup sensitivity and loading range are investigated theoretically and experimentally. Design values of the pickup parameters at pressures of  $10^2$  and  $10^5$  and the results of lab tests of 20 gauge samples are summarized. The pickup has a sensitivity threshold of 15-45 Pa and a sensitivity of 0.121-0.324  $\mu\text{V}/\text{Pa}$ . The discrepancy between the control instrument and the new thin film pickups is 3-5 percent; the sensitivity spread is due to the film thickness variations within 10-12  $\mu\text{m}$ . The sensor has 6 x 9 mm dimensions. Tests of pickups in a flow at 41-145 m/s velocities and a static pressure of  $10^5$  Pa with up to 7 kPa fluctuations at a 5 kHz frequency confirm their serviceability. Discrepancies from the readings of the DMI-06 control pickup do not exceed 2 dB. The author is grateful to Dr. A.N. Petunin for assistance. Figures 3; tables 2; references 3.

#### Hall Effect-Based Torque Transducer

927K0335G Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 p 26

[Article by V.G. Shepelevich, A.A. Klishin, D.V. Stepanov, A.Yu. Shulpenkov, Belarussian State University imeni V.I. Lenin; UDC 621.318.538.26]

[Abstract] The constraints of traditional torque transducers (DKM)—due to the need for thin current pickoff slip rings for feeding the Hall generator (PKh) and picking up its output signals—which significantly shorten their service life prompted the development of a torque transducer design which employs a single Hall generator and does not require collector rings. The magnetic circuit and measurement block diagram of the new torque transducer are cited and the dependence of the output signal amplitude on the mutual displacement of the pole tips is plotted. Within a shaft speed of 350-1,400 RPM, the amplitude signal variation does not exceed 5 percent at a pole tip displacement magnitude of less than 2 mm. The torque transducer makes it possible to measure not only the shaft torque but also its sign and determine the rotation speed. Figures 3; references 4.

#### Hall Generator-Based Magnetosensitive Hybrid Integrated Circuit

927K0335H Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 26-27

[Article by A.I. Demchenko, A.P. Drapezo, A.L. Potapov, Special Design and Technology Office at the

Solid State and Semiconductor Physics Institute at the Belarussian Academy of Sciences; UDC 681.586.32:621.3.049.77-181.48]

[Abstract] A new promising trend in the design and mass production of electronic transducers of mechanical quantities—pickups based on analog magnetosensitive integrated circuits (AMGIS) which combine in the same body all functional pickup elements, i.e., the primary transducer, a power supply with a current and voltage regulator and a rectifier, an amplifier, an output signal generator, and temperature compensation elements—is discussed and an analog magnetosensitive integrated circuit developed at the Special Design and Technology Office of the Solid State and Semiconductor Physics Institute at the Belarussian Academy of Sciences (IFTTP) is described. The hybrid IC is intended for operation within a transducer with an expanded temperature range and employs microminiature heteroepitaxial Hall generator structures as its sensor. The heteroepitaxial Hall generator structure parameters and the principal specifications of the analog magnetosensitive integrated circuit are summarized. The microminiature Hall generators (MPKh) are produced by the photolithography method with subsequent laser scribing from commercially made ISES 5 x 6 TU11-77 YayeO.032.016TU heteroepitaxial structures on a glass ceramic substrate. The analog magnetosensitive integrated circuits are very reliable within a broad temperature, acceleration, and vibration range and can be used as standardized multi-purpose elements. Figures 1; tables 2.

#### Estimating Rotameter Manufacturing and Parameter Adjustment Quality by Float's State in Flow

927K0335I Moscow PRIBORY I SISTEMY  
UPRAVLENIYA in Russian No 2, Feb 92 pp 30-31

[Article by N.V. Arkhangelskiy; UDC 681.121.84.38]

[Abstract] The design and operating principle of a simple rotameter, i.e., a constant pressure drop flow meter consisting of a transparent conical tube which houses a float, are outlined and a device developed for adjusting the rotameter which makes it possible to change the position of the flow meter's longitudinal axis in a spherical system of coordinates by moving its upper end in two mutually perpendicular directions relative to the hinged lower end and graphically record all possible upper end positions on a fixed plotter is described. A schematic diagram of the rotameter alignment device is cited and the dependence of the rotameter alignment circle merger on the values of normal rotameter area limits at various conical tube cross sections is plotted. An analysis of the figures drawn on the fixed plotter makes it possible to evaluate the rotameter production and adjustment quality. It is noted that mass produced rotameters with the same measurement range have a small spread between the optimum positions of the longitudinal axes and deviations of the normal area



limits, i.e., are characterized by a close "grouping" of values. Figures 2; references 4.

### Operating Characteristics of Nonfoil-Plated Dielectric Printed Boards

927K0335J Moscow *PRIBORY I SISTEMY UPRAVLENIYA* in Russian No 2, Feb 92 pp 40-41

[Article by S.V. Perminov, Special Design Office of the Scientific Production Association Neftekhimavtomatika; UDC 621.3.049.75:621.793.1]

[Abstract] Production of printed boards (PP) by the vacuum deposition technique with subsequent galvanic conductor shaping first substantiated in *Pribory i sistemy upravleniya* No. 6, 1991, pp. 32-33, is discussed; the new process is based on the equipment for base printed board production by the combined positive method and uses the materials stipulated by various GOST and OST standards. Printed board production involves incoming control of materials according to GOST and specifications (TU), production of blanks, adhesive layer application, hole drilling in machine tools with numerical control, vacuum deposition, electrolytic copper plating and protective Sn-Pb layer application, protective relief removal, deposited sublayer pickling, Sn-Pb layer fusing, and rust-prevention treatment. The specific features of the above operations are outlined and it is noted that the process differs from the base process only on the adhesive layer application and vacuum deposition procedures. The productivity of the equipment necessary for carrying out these functions is summarized and the economic efficiency of the new printed board technology is estimated. Implementation of the procedure makes it possible to recover procurement outlays in three years. The new technology is being implemented today at the Omsk pilot plant of the Neftekhimavtomatika Scientific Production Association. Tables 2; references 1.

### Amplitude Measurements of the Piezoelements Oscillations With a Laser Profilograph

927K0334A Moscow *IZMERITELNAYA TEKHNICA* in Russian No 5, May 92 pp 20-21

[Article by A. M. Brodnikovskiy, I. Yu. Krikov; UDC 53.083.71.087.6]

[Abstract] A laser profilograph was developed, capable of making remote controlled measurements of the profile of the objects surface with a resolution in height of about 10nm. Shift in space of the laser beam reflected from the object's surface is used in this profilograph for measurements of the profile or its oscillations. The laser beam is focused on the surface of the examined object, and after reflection from the surface the beam is received by a lens, then it is collimated and strikes a coordinate sensitive photo-detector, consisting of four photo diodes. Shift of the object's surface height in the focus of the lens causes a parallel shifting of the beam surface of the photo

diodes. Vertical shifting of the examined surface generates a signal at the photo-detector output. After amplification this signal arrives at the input of a synchronous detector. With this device, measurements can be made of signals reflected from any surface, however, measurements of surfaces with a specular reflection will produce a better accuracy. For measurements of the piezoelements' surface, a piece of mirror was attached to its surface. Figure 1, references 2: 1 Russian, 1 Western.

### Analysis of the Critical Beams of a Scattering Diagram in the Frontal Hemisphere

927K0334B Moscow *IZMERITELNAYA TEKHNICA* in Russian No 5, May 92 pp 25-26

[Article by A. V. Androsik; UDC 535.36.:681.7.068]

[Abstract] By probing fiber optic (FO) light guides with a narrow beam it is possible to determine the relationship between the parameters of the examined light guide and the characteristics of the beam. The behavior of the critical beams of the scattering pattern by a two-layered FO light guide was examined in this paper. It was demonstrated that both, the geometrical and optical characteristics of the FO light guide can be obtained simultaneously from the scattering pattern. The behavior of the two initial beams, one of which is refracted, and the other reflected from the interface was examined. One of these beams passes through the core and the shell, and the other only through the shell. Interference of these beams causes modulation of the rings intensity, thus the relationship between the geometrical and optical parameters of the FO light guide can be established. Curves were obtained for different ratios between the core and the shell  $r_2/r_1$ , for fixed values of the index of refraction. It was demonstrated that for fibers with a small diameter of the core, the shell diameter can be determined regardless of the core diameter by measuring the scattering pattern at large angles. Figures 3, references 2 Russian.

### A Method for Measuring the Magnetic Field Parameters From a Mobile Platform

927K0334C Moscow *IZMERITELNAYA TEKHNICA* in Russian No 5, May 92 pp 55-57

[Article by V. M. Smirnov; UDC 535.12.089.5]

[Abstract] Measurement methods of the magnetic field parameters from a mobile platform are used in aeromagnetic, marine and satellite mapping for studies of the Earth's magnetic field. These methods are also used for measurements of the magnetic field of the Sun plasma and the magnetic field of planets from space vehicles. The magnetic compatibility problems of the mobile platform with the magneto-sensitive converters are still not resolved. A method is described for measuring, at a selected point, the magnetic field induced by a moving body in the presence of an external homogeneous magnetic field, for example, the magnetic field of the Earth.

After excluding the value of the magnetic field induced by the magnetic body from the resulting value of the magnetic induction, the vector of the external homogeneous magnetic field can be determined. In addition, if the effect of the higher order magnetic moments are neglected, the dipole magnetic moment of the magnetized body can also be determined by the method described in this paper. References 5 Russian.

**Interferometer for Certification of Instruments Measuring Thin-Film in the Nanometer Range**  
927K0334D Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 5, May 92 pp 13-14

[Article by M. A. Kosmina]

[Abstract] An instrument for certification of thin-film measurements in the nanometer frequency range is described. The instrument was developed at the Scientific Production Association of the All-Union Scientific Research Institute of Metrology. It functions on the principle of a double two-beam interferometer with an acousto-optical modulator. The interferometer, which is constructed using a differential circuit, is insensitive to the instrument's tilt and instability of the acoustic wave phase. A block diagram of the instrument is provided. The particular feature of the instrument is that three beams are used in the interference process. The beams are reflected from the sample and are propagating along very close trajectories. With this feature it is possible to obtain two interference signals, the measuring signal and the reference signal, which are formed under identical conditions and are responding in an identical way to their changes. Measurements of the film thickness consist in determining the difference in course of the two beams, normally reflected from the film surface and the open surface of the substrate. Figure 1, references 8: 3 Russian, 5 Western.

**Indirect Method for Calibration of the Belt-Conveyer Weigher**  
927K0334E Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 5, May 92 pp 18-20

[Article by Yu. V. Gudovskiy, V. K. Donis, V. M. Sin]

[Abstract] Calibration of the belt-conveyer weighers (BCW) by passing the already weighted material is frequently impossible to perform under field conditions. A study was carried out for the development of indirect methods and facilities for calibration and inspection of the belt-conveyer weighers. The known methods and devices are accurate only for a narrow range of the BCW operation. Calibration methods without the use of special technical equipment are more simple and preferable. One of these methods consists of comparing the weight of material located on the measuring section of the conveyer belt with the actual indications of the BCW and

static measurement after the samples are removed from the belt. A mathematical model of the process was developed and described.

**Effect of Data Processing Discreteness and Automatic Monitoring Device Errors on Analog-Digital Entity Monitoring Confidence**  
927K0333A Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 10-11

[Article by B.I. Dotsenko, Yu.I. Shepelev, M.Sh. Gelmedov; UDC 53.088:65.012.7.011.56]

[Abstract] The use of microprocessor technology in today's entities and automatic monitoring facilities (ASK) and information interchange between them in a digital form call for taking into account the effect of errors and moving failures on the monitoring outcome. Thus, the effect of the data processing discreteness and automatic monitoring facility errors on the confidence of the monitoring indicators—the maker and user risks—is investigated and formulae are derived for the manufacturer and customer risks. For illustration, an analog signal on the input of the monitoring channel distributed by a given law entering a G-bit analog-to-digital converter (ATsP) with a specified conversion discreteness is considered. An analytical procedure is developed making it possible to calculate the instrumental risk of the maker and user for each monitored variable allowing for the analog channel section gain, analog and digital section errors, and the analog-to-digital conversion discreteness. Figures 2; references 4.

**Digit-by-Digit Coding Analog-to-Digital Converter With Intermediate Storage and its Metrological Support**  
927K0333B Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 12-14

[Article by S.N. Karpov, A.S. Pevzner, O.V. Soboleva; UDC 389.14:53.087.92]

[Abstract] The shortcomings of existing digit-by-digit analog-to-digital converters whose principal elements are a digital-to-analog converter (TsAP), a comparator, a summing amplifier, and a shift register, e.g., low speed and an additional dynamic error, and the desire to save the volume of elements used and produce an analog-to-digital converter whose conversion time is several microseconds at a sufficient word length, led to the development of ATsP 13/20 and ATsP 16/60 with 13 and 16 binary digits at a 20 and 60  $\mu$ s conversion time, respectively. The devices developed in the CAMAC standard at the Special Design Office of Analytic Instrument Making at the Academy of Sciences are described and their block diagram is cited. The conversion cycle is divided into two steps: in the first, the device determine the input voltage polarity and isolates its magnitude while the in the second, the output voltage stored in analog memory (AZU) is weighted. A testing procedure

developed using an SM-4 computer and special signal generator (G6-48) is outlined and the testing algorithm is presented. The converters are manufactured by a pilot plant of scientific instrument making at the Scientific and Engineering Society at the Academy of Sciences; the test results of ten batches of ATsP 16/60 made in the first quarter of 1990 are summarized. It is noted that the methods of determining the metrological characteristics are at a low automation level due to the lack of mass produced voltage calibrators with sufficient parameters; for this reason, the converter dynamic errors are not standardized although the converters may otherwise be used for digitizing slow signals in automatic systems. Figures 1; tables 1; references 4.

### Sine-Cosine Signal Interpolator

927K0333C Moscow IZMERITELNAYA TEKHNKA  
in Russian No 3, Mar 92 pp 21-22

[Article by O.D. Glukhov, L.Ya. Lebedev, V.I. Pritsker, V.D. Sverdlichenko; UDC 681.335.87]

[Abstract] The expanding uses of interferential measurement methods combined with a constantly increasing stringency of accuracy requirements necessitated the development of automatic interference order meters with a high resolution. In the case where data on the order of interference are represented as two harmonic signals shifted in phase by  $90^\circ$ , sin-cos interpolators are necessary. The design principle of an interpolator which considerably increases resolution without significantly complicating its equipment by using a single null detector (NO) alternately connected through a switch to the nodes of a resistive phase-shifter is described and a block diagram of such sin-cos interpolator is cited. The interpolator's accuracy is usually determined only by the accuracy with which the phase-shifter resistors are selected. A device with two identical instrument channels and a common interface which ensures byte-by-byte measurement data input from each channel is developed on the basis of the interpolator. The two-channel meter of the order of interference may be used in metrological and production practices for measuring displacement in two coordinates simultaneously or for accurate length measurements. Figures 1; references 3; 2 Russian, 1 Western.

### Device for Measuring Thickness of Dia- and Paramagnetic Items

927K0333D Moscow IZMERITELNAYA TEKHNKA  
in Russian No 3, Mar 92 pp 26-27

[Article by B.P. Fridman; UDC 531.717.1: 53.082.74(088.8)]

[Abstract] A device for measuring the thickness of items and intended for nondestructive profile testing of the wall thickness of hollow items with a complex shape made from insulating and dia- and paramagnetic materials which also make it possible to test hollow and open

items with a 0.5-12.0 mm wall thickness is described and its schematic diagram is cited; its measurement error does not exceed 3 percent of the tested value. The design and operating principle of the device and its components are outlined in detail. The device is characterized by an elevated promptness of results and profile measurement convenience. In addition to profile measurements of hollow and partially closed nonmagnetic products, it is capable of measuring the thickness of open structural members and sheet products of varying dimensions. Figures 1.

### Gain Measurement in Multimodule CO<sub>2</sub> Lasers

927K0333E Moscow IZMERITELNAYA TEKHNKA  
in Russian No 3, Mar 92 pp 30-31

[Article by V.N. Antipov, I.F. Bukhanova, V.M. Zhuravel, S.F. Ivanov; UDC 535.231.12.083]

[Abstract] A method of measuring the active medium gain (KU) of a multimodule multichannel CO<sub>2</sub> laser by using the laser's intrinsic emission whereby the gain determined by the ratio of power values in each module is described and data on realizing the method with the help of spectral emission components are presented. The spectral components of the LN-1.2 NM and LN-2.5 NM lasers are measured by an infrared spectrometer with a 6 Hz time base together with an XY emission selector. The difference of the intensity ratios calculated by the spectral components from their integral values and an alignment chart for calculating the gain error are plotted. The gain of the LN-1.2 NM laser is measured using this method and is found to be equal to 1-1.4 m<sup>-1</sup> without an active medium regeneration or from 0.9 to 1.6 m<sup>-1</sup> with regeneration; the gain measurement error is 10-50 percent. It is noted that in order to increase accuracy, it is necessary to separate the waveguide components from the laser's emission and take into account only the direct components of the intensity ratio. Figures 2; references 5.

### Power Density Measurement of Pulsed Focused Laser Radiation

927K0333F Moscow IZMERITELNAYA TEKHNKA  
in Russian No 3, Mar 92 pp 33-34

[Article by V.Yu. Glina; UDC 535.231.11.083]

[Abstract] The difficulties of direct measurements of the power density distribution in the beam cross section at the focus point necessary for many plasma physics applications are noted and a new method is proposed. An opaque plate of metal or semiconductor material with a smooth specular surface is placed perpendicular to the focused laser beam and it is assumed that this surface has a certain critical laser radiation density causing the surface to break down. According to this assumption, the crater boundary on this surface corresponds to the critical density. The dependence of the power density of focused laser radiation on the distance



to the focal spot center is plotted and a procedure for determining the power density is outlined. An experiment with a  $1.06 \mu\text{m}$  YAG:Nd is described. The calculated power density reached  $2 \times 10^8 \text{ W/cm}^2$  while the values do not differ by more than 20-30 percent from measurement to measurement. The experiment confirms the possibility of determining the power density of pulse laser radiation in the beam cross section. Figures 1.

### Multicycle Phase Shift Measurements

927K0333G Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 41-43

[Article by A.A. Ishutin; UDC 621.317.772]

[Abstract] The low confidence and accuracy of the devices for measuring the number of integral phase cycles (KFTs) used as a component of multicycle phase meters prompted a search for new measurement methods and circuit designs which realize these methods. A device for counting integral phase cycles with a high confidence of multicycle phase shift angle measurements under identical conditions which makes it possible to record transitions across the cycle boundaries during phase jumps of  $360^\circ$  or more is described and its block diagram and timing chart are cited. The device can be optimally integrated with a digital phase meter from the viewpoint of hardware outlays, speed, and likely uses in a digital multicycle phase meter. Due to the prepositioning of the reversible counter and the prepositioning code compensation, the device is capable of taking measurements under phase fluctuation conditions reaching  $360^\circ$ . If certain modules are common to the phase meter and integral phase cycle counter, popular 597SA2 chips can be used. Figures 2; references 2.

### Magnetic Film Hall Generators

927K0333H Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 43-45

[Article by V.I. Prokoshin, V.A. Yarmolovich, I.I. Vasilyev; UDC 588.123+621.3.083.8]

[Abstract] The limits of miniaturization of conventional Hall generators and the difficulty of finding their substitutes—which is especially important in recording magnetic fields with a localization area of several micrometers, such as magnetic data media—prompted an examination of the use of magnetic film Hall generators. These devices' operation is based on using the planar Hall effect which makes it possible to increase their sensitivity in the area of weak magnetic fields while maintaining the degree of miniaturization and practicability of elements. The design and operating principle of magnetic film Hall generators are described and their relationships are derived. A theoretical dependence of the output signal of a magnetic film Hall generator on the external magnetic field in the case where its vector coincides with the axis of easy magnetization and an experimental curve for Fe-Ni films deposited on a glass

ceramic substrate are plotted. It is shown that the Hall generator magnetic sensitivity can be further increased by improving the film deposition conditions and using new compositions. In additions to the high sensitivity, the film Hall generators have other advantages over traditional semiconductor designs: a high time stability, a low sensitivity to external exposures, and a lack of photosensitivity. The expediency of adopting and using these devices is demonstrated. Figures 2; references 7.

### EHF Wide-Band Diode Measuring Attenuators and Modulators

927K0333I Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 45-48

[Article by A.S. Zarubin; UDC 621.382.2]

[Abstract] The advantages and shortcomings of various distributed and lumped diode structures for millimeter band (EHF) wide-band measuring attenuators and modulators are discussed; analyses show that for the parameters typical of today's domestically made diodes, parallel connection of diodes in a slotted waveguide transmission line (VShChL) is optimal. The frequency characteristics of these devices are examined and the frequency dependence of attenuation of a parallel connected diode with and without a series or parallel compensating inductor is plotted. For example, a diode with parallel inductive compensation has a service band of 53.57-78.33 GHz, making it possible to develop wide-band matched attenuators on its basis with a voltage standing wave ratio of 1.5-2 within the entire dynamic range. An experimental investigation of devices with 2A553 diodes confirms that modulators and matched attenuators with an amplitude-frequency response flat within 1-3.5 dB and a speed of 20-30 ns can be developed. Improvements in the component base elements will make it possible to expand the service band to 120-180 GHz. It is noted that the findings are equally as valid for single- and multichannel switching devices. Figures 1; references 10: 9 Russian, 1 Western.

### Method of Assessing Spectrometric Channel Dead Time Using Two Periodic Signal Generators

927K0333J Moscow IZMERITELNAYA TEKHNIKA  
in Russian No 3, Mar 92 pp 56-57

[Article by T.N. Lavrenyuk, G.G. Abezgauz, Ye.N. Vladimirov, A.Z. Pliss; UDC 539.1.074.088.3]

[Abstract] The Poisson of the radiation excitation and conversion in X-ray and radio isotope-based analytical instruments with a spectrometric channel leads to a discrepancy between the mean pulse repetition frequencies (SchS) on the spectrometric channel (SK) input and output or resolving (dead) time. A method of determining the dead time based on applying two identical periodic signals with different periods from a period signal generator through a linear adder is described and the dead time calculation procedure is illustrated using

two examples. By calculating the dead time, the method makes it possible to establish the ionizing radiation intensity on the basis of signal frequency measurements taken on the instrument channel output for various

applications, particularly in determining the composition and structure of various substances. The method is sufficiently accurate and reproducible and can be easily automated. References 3.

**Macrodefects Near Seeds and Their Elimination With Laser Recrystallization of Polysilicon**

927K0313A Moscow MIKROELEKTRONIKA  
in Russian Vol 21, No 1, Jan 92 pp 14-20

[Article by V. M. Glazov, I. A. Shumskiy, Moscow Institute of Electronics; UDC 621.382]

[Abstract] Laser recrystallization of polysilicon layers on oxide is an important process for the development of metal-insulator semiconductor (MIS) integrated circuits. However, this process is not a simple one, and many theoretical problems must be solved. One of them is the orientation control of the silicon monocrystal clumps, which are formed in the process of the silicon films recrystallization on the amorphous dielectric substrate. Seeds are used for obtaining clumps of a reproducible orientation. However, macrodefects can be formed near the seeds. The effect of technological factors on the formation of these defects is discussed in this paper. The results of study indicate that by reducing the seed's area the generation of defects in the crystallized silicon films (RSF) is reduced. It was also revealed that some seeds do not perform their function, that is, do not control the orientation of the silicon film recrystallization. A probability analysis was carried out for a successful seeding in an array of point seeds located under the RSF strips. It was demonstrated that the probability changes from strip to strip. Figure 7, references 9: 3 Russian, 6 Western.

**Optimal Design of C-MOS-Base Matrix Crystals**

927K0313B Moscow MIKROELEKTRONIKA  
in Russian Vol 21, No 1, Jan 92 pp 21-29

[Article by V. A. Gergel, G. V. Kristovskiy, G. I. Oreshkin, Scientific Research Institute of Physical Problems Moscow Institute of Electronics; UDC 621.382]

[Abstract] This paper examines the construction optimization of complimentary metal oxide semiconductor (C-MOS) base matrix crystals (BMC). Methods are developed for optimization of the MOS transistor's geometric parameters and junctions, and the analysis is made of the fundamental reasons causing the reduction of speed. It was shown that the geometric dimensions of the transistors greatly depend on the parasitic resistances of the MOS transistors which are produced by the resistance of the diffusion regions at the source, drain and contacts. A C-MOS BMC was designed and fabricated containing 198 78 4-transistor base units with optimized geometric dimensions of the MOS transistors:  $L_{on}=1.03\mu\text{m}$ ,  $W_n=153\mu\text{m}$ ,  $W_p=203\mu\text{m}$ . A table listing the time delays of this BMC logic elements is also provided. A comparison of the obtained experimental data with the theoretical indicates that the real time delays in this BMC were greater than the computed delays by a factor of 1.4, which is caused by the non-optimal selection of the connecting lines width. Figure 5, tables 2, references 11: 7 Russian, 4 Western.

**Study of Charge Transfer Losses in a Charge Coupled Device Operating in the Accumulation Mode**

927K0313C Moscow MIKROELEKTRONIKA  
in Russian Vol 21, No 1, Jan 92 pp 49-52

[Article by N. E. Bokk, Kh. I. Klyaus Ye. I. Cherepov, Institute of Semiconductor Physics, Siberian Branch of Russian Academy of Sciences; UDC 621.382]

[Abstract] Charge transfer losses in a charge coupled device (CCD) operating in the accumulation mode, at 77°K were investigated and the results are discussed in this paper. A new type of the CCD output signal degradation was uncovered, which is related to the recombination of captured electrons with holes arriving from the stop-diffusion region after transfer of the mobil signal charge to the neighboring electrode. The uniquely large losses in the examined CCD operating under normal electrical modes can be eliminated by blocking the holes injection with application of a cut-off voltage in the stop-diffusion region. This would reduce the charge transfer losses down to values which will make possible a practical use of such CCD. Figure 4, references 5: 3 Russian, 2 Western.

**Changing Properties of Crystalline Elements of the Silicon Matrix Resulting From Submicron and Nanometer Technology**

927K0313D Moscow MIKROELEKTRONIKA  
in Russian Vol 21, No 1, Jan 92 pp 66-68

[Article by V. P. Bokarev, M. Yu. Vakhruhev, "SUB-MIKRON" Scientific Research Institute; 621.382]

[Abstract] An equation was developed relating the linear dimensions of the technological elements of a "column" type silicon crystal with an average coordination number of atoms in such elements. It was demonstrated that changes of the coordination number of atoms in a submicron size crystal elements of silicon are identical with changes of the coordination number of atoms in a infinite silicon crystal containing vacancies with a concentration greater than  $10^{19}\text{cm}^{-3}$ . A conclusion was made of the necessity of accounting for changes in the electro-physical and other properties of the silicon elements with submicron dimensions when designing very large scale integrated circuits with a capacity greater than 64 Mbit. Figure 2, references 4 Russian.

**Large-Scale Heterogeneity in GaAs Samples With an Anomalous Dependence of the Charge Carriers Concentration on Temperature**

927K0313E Moscow MIKROELEKTRONIKA  
in Russian Vol 21, No 1, Jan 92 pp 85-89

[Article by V. P. Kalinushkin, S. Ye. Zabolotskiy, B. A. Yuryev, A.K. Abiyev, E. T. Mamedov, N. S. Babazade, Russian Academy of Sciences Institute of General Physics; 621.382]



[Abstract] Large-scale impurity concentrations in monocrystals of non-doped GaAs, and GaAs compensated by 3.5 MeV electron irradiation, and also doped Te(GaAs:Te) and Sn(GaAs: Sn) were studied by the method of small angle light scattering. As a result of the study it was revealed that an anomalous temperature dependence of the Hall coefficient and resistivity in the GaAs samples irradiated by the electrons is always observed in the GaAs:Te and GaAs:Sn. This indicates that the nature of the anomaly is not related to either the electron irradiation or to the type of doping. It can be

confidently assumed that the only effect of both, the irradiation and doping, while compensating the conductivity, is to create the observation conditions of this phenomenon. Peaks, corresponding to centers with depth  $E_c$  eV: 0.23, 0.32; 0.51; and 0.94 were uncovered in the GaAs DLTS spectrum after a fast cooling of the samples. Based on the results of the study it can be also assumed that in the examined samples changes occur in the dope concentration at reduced cooling rate in the temperature interval 170-220K, which cause an increased concentration of free carriers. Figure 4, tables 2, references 17: 12 Russian, 5 Western.

**Yesterday and Tomorrow of the Volga Institute of Informatics, Radio Engineering, and Communications**

927K0359A Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 2-3

[Article by; V. B. Vitevskiy, A. P. Kononov]

[Abstract] The Volga Institute of Informatics, Radio Engineering and Communications (previously: Kuybyshev Elektrotekhnicheskiy Institut Svyazi) was founded in 1956. In September 1991 it celebrated its 35th anniversary. A short review is given of its history, and the present problems and accomplishments are discussed. The institute has expanded the range of specialization. At the beginning of the school year 2301 students registered at the new Radio Engineering Department. Contacts are strengthening with the industry; several branches of the departments are set up at the city's large communication enterprises. A scientific production association has been founded jointly with the Samara Polytechnic Institute for Communications. New forms are developed for organization of the scientific research, and new laboratories are opened for studying the contemporary problems in the fields of communication technology: control systems, fiber optics, cable TV etc. A branch of a joint Soviet-Columbia scientific enterprise KWAZAR-INFO has been established. The financial difficulties hold back the construction of facilities and procurement of the needed equipment.

**Element-by-Element Reception of Discrete Messages in Channels with Between-Character Interference and Decision Feedback**

927K0359B Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 3-5

[Article by; D. D. Klovskiy; UDC 621.391:621.396]

[Abstract] A short review is made in this paper of some earlier works by the author in the area of adaptive signal processing with a sequential (single channel) transmission of discrete messages by channels with intersymbol interference and varying parameters. Studies of the methods of optimal adaptive reception indicate that the high-speed sequential systems for transmission of discrete messages, based on the principle of element-by-element reception with the decision feedback and also with a joint demodulation and decoding, are very promising for employment not only in the communication lines, but also for the multibeam radio channels in different wave range, including the channels with selective fading. This material is instructive for young specialists. It demonstrates the domestic leadership in the field of optimal signal processing with intersymbol interference, and when using the decision feedback. References 17: 12 Russian, 5 Western.

**Statistical Characteristics of Soliton Optical Communication Systems**

927K0359C Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 6-8

[Article by; S. M. Shirokov; UDC 621.7.068]

[Abstract] One of the methods for increasing the transmission capacity of fiber optic communication lines is based on using solitons and similar non-linear transmission modes which provide compensation for a dispersing expansion of the pulsed signals. An optical channel was examined which included a modulator with a laser source, a single-mode fiber optical lightguide and a receiving module, providing a transmission of binary picosecond pulses in a linear, near soliton, mode. The results of the study indicate that with the soliton communication systems, a correct selection of the radiation source (with a degree of coherency not smaller than the signal duration) assures a significant increase in speed and range of transmission, when compared with the linear systems, even if a simple algorithm is used for reception of the optical signals. Figure 2, references 11: 9 Russian, 2 Western.

**Problems of the Electromagnetic Ecology**

927K0359D Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 8-9

[Article by; Yu. M. Spodobayev; UDC 658-3.043]

[Abstract] Problems of the electromagnetic ecology (EE) are discussed. Understanding these problems is of great significance for the protection of men and environment from harmful effects of electromagnetic radiation. The problems of the EE and electromagnetic compatibility are closely related, and are treated as a compatibility of the ecologic systems with the man-made electromagnetic radiation. Within the framework of the EE problems, lists are prepared, based on clinical physiological and biophysical data of biologically active parameters of the electromagnetic field, and norms are specified for tolerable levels of radiation. This aspect of the EE is examined here. According to the author, the norm setting and accumulation of information on the electromagnetic radiation is an important but insufficient procedure. A more productive approach would be studying the reaction of the biological components of the ecosystems to the effects of any contaminating factors and the development of scales of the harmful effects. A system for automatic prediction of the electromagnetic situation has been developed at the Volga Institute of Informatics, Radioengineering and Communications and is operational. It can analyze the effect of all radiation components of a single antenna, and antenna arrays, with estimates of contributions from each antenna.

**Terminal Set for Digital Transmission Systems Built on LSIC***927K0359E Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 12-15*

[Article by; Yu. P. Ivanov, L. S. Levin, A. B. Tikhonovich, M. Ya. Vertlib; UDC 621.376.56]

[Abstract] The fundamental concepts and engineering solutions for the design of terminal equipment of digital transmission systems (DTS) have already been established and any further modifications of the circuit can not radically improve its parameters. Perfection of engineering and economic characteristics of the DTS depend on new designs of the element base, specifically, on the LSIC's, and on the development of a new generation equipment, based on that design. The principal requirements imposed on the element base are a high level of integration, speed, reliability, and low power consumption. Several special purpose LSIC were developed for a more economic realization of the fundamental functional units of a primary PCM-multiplexer, and their composition is discussed in this paper. The LSIC developed for the channel forming and the time grouping equipment makes it possible to design a terminal DTS equipment with improved characteristics. Tests are now conducted on its design. It is expected that between 1994 and 1996 the equipment will be in mass production. Figures 5, tables 2, references 5: 4 Russian, 1 Western.

**A Method for Increasing the Utilization Efficiency of High Frequency Bands, Allotted to the Broadcasting Services***927K0359F Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 25-26*

[Article by; A. N. Isayev, V. G. Dotolev, O. I. Sergeyev, A. T. Titov; UDC 621.391.97]

[Abstract] A method is proposed for increasing the utilization efficiency of HF bands by employing the surface wave for radio broadcast. Normally, the ionospheric waves are used for a long distance broadcasts in the HF range. In this case, the surface wave is an undesirable radiation, and in order to assure a good reception of the ionospheric wave, the operating frequencies are traditionally selected in the range between the lowest usable (LUF) and the maximum usable (MUF) frequencies. When the surface wave is used for the broadcast, the ionospheric wave must be attenuated, because interferences can be generated at different distances from the source, thus, the operating frequencies must be either below the LUF, or above the MUF. One method of attenuating the ionospheric wave consists in selecting the operating frequencies which are not reflected by the ionosphere, but will penetrate it. With proper selection of the operating frequency, it is possible to achieve this situation for night-time, as well as for day-time broadcast. This non-traditional utilization of the operating frequencies significantly reduces the level of noise generated by local networks of international HF

broadcast. The advantages of this method lie in that there is no signal fading with the surface wave reception, which significantly improves the broadcasting quality, compared to the ionospheric wave. Tables 1, references 7: 6 Russian, 1 Western.

**The "Fiber Optic Technology" Association: Promotion of the FOT is the Most Urgent Task of the Present***927K0359G Moscow ELEKTROSVYAZ in Russian  
No 3, Mar 92 pp 30-32*

[Article by; S. A. Dmitriyev; UDC 621.395.44]

[Abstract] A review is made of the present state of the art of the fiber optic technology (FOT), and the activity of the recently founded "Fiber Optic Technology" Association is described. The principal objectives of the Association consist in preserving the scientific and engineering potential gained by the Association members' enterprises, and conversion of this potential to the needs of the National Economy. The other objective is development of specific fiber optic communication lines and systems. For realization of these goals, the Association concentrates its efforts on providing information and coordination, and on promotion of the development of the fiber optic technology (FOT). The promotion of the FOT is carried out in four directions. The first direction deals with the development of cable TV. The second direction concerns the development of fiber optic multichannel transmission systems, primarily telephone communications. The third direction is in promoting the utilization of the FOT for computer networks. The objective of the fourth direction is the development of fiber optic sensors and systems for collecting and processing information. The specific features of these objectives are described and examples cited. The multifaceted activity of the Association is founded on new economic principles of market economy and will expedite the promotion of the FOT in the interests of consumers.

**'Intersputnik' Today and Tomorrow***927K0325A Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 p 7*

[Article by G. Zadonskaya, Russia's Communications Ministry]

[Abstract] The proceedings of the twentieth anniversary session of the Intersputnik International Space Communications Organization Union held in Alma-Ata in the fall of 1991 are summarized; delegates from sixteen countries took part in the conference. The participants reviewed the track record of the Intersputnik organization since its inception in 1971 in the framework of its charter which calls for coordinating efforts of member countries in developing, designing, implementing, and operating a communication system using satellites. The contributions of various members are discussed and the new tasks facing the Intersputnik organization in the



future, particularly keeping up with state-of-the art technology and accelerating the development of multi-channel communications satellites operating in the 6/4 and 11/14 GHz band with modern parameters and a capacity margin sufficient for 10-15 years, are outlined. The congress adopted a memorandum on mutual cooperation with the Intelsat signed by the organizations' respective directors Dean Birch and Boris Chirkov.

### TV and Radio Broadcasting Licenses

927K0325B Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 9-10

[Article by S.V. Glubokov, Russia's Communications Ministry]

[Abstract] The changing face of TV and radio broadcasting in Russia due to the emergence of numerous nongovernmental associations, corporations, and funds involved in providing information services forced the Communications Ministry to issue in 1991 over 100 licenses in 1991—75 of them "general" licenses to enterprises which, in turn, can issue licenses of their own for servicing a specific territory—and prompted it to reevaluate the licensing procedure. Consequently, decree No. 500 "On licensing TV broadcasting, radio broadcasting, and communications activities in the sphere of television and radio broadcasting in the RSFSR" was adopted by the RSFSR Council of Ministers on 26 September 1991. Subsequently, an *ad hoc* statute on licensing was adopted by decree No. 357 of 22 October 1991. The procedures for applying for, and issuing the TV and radio broadcasting licenses to legal entities and citizens of Russia are outlined in detail. The responsibility and authority of a commission on broadcasting which the final decision on whether or not to grant a five-year license *ad/or* renew it later are described. The cases in which a license may be suspended or revoked are discussed. It is noted that up to print time, no decision had been made on charging a license fee.

### Satellite Communications for Russia's Citizens

927K0325C Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 16-17

[Article by S.V. Glubokov, Russia's Communications Ministry]

[Abstract] The increasing role of satellite technology in the development of communication systems and the tremendous success in providing TV and radio programs almost to the entire population of Russia are discussed and it is noted that Russia's first satellite—the Gorizont-40°—was launched in 1990 while plans call for bringing on stream two more before the end of 1992—the Gorizont-103° and Gorizont-145°. These satellite will make it possible to provide TV and radio broadcasting and telephone service virtually to all rural inhabitants of the Far North, Siberia, and Far East. The use of simple and economical small earth stations (ZS) Moskva and Ekran

in sparsely populated areas and the capabilities of the new Rabita local radio broadcasting system are outlined and the specific uses of the existing ten satellites in providing area-wide telephone communication and other information services to remote areas of Russia are summarized. Future plans for developing a new generation of spacecraft (KA) and reevaluating the utilization of the Gorizont, Molniya, and Raduga satellite are reviewed. The increasing utilization of multichannel communication systems operating in the 14/11 and 6/4 GHz band with 2.5 and 4.5 m earth station antennas is stressed and the development of direct broadcast facilities is reported. The new systems will be financed from the state budget, by user fees and joint venture participants, by bank loans, and from operating revenues.

### Urban Wired Broadcast Network Design

927K0325D Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 20-21

[Article by I.L. Korin, Giprosvyaz-3 Institute]

[Abstract] The increasing importance of wired broadcast outlets—the so-called rediffusion service—under the conditions of wide-spread shortages of goods where it is virtually impossible to acquire a radio receiver, a TV set, or any other electronic appliance from retail stores is noted and the implementation of cable lines and a trend toward combining the uses of wired broadcasting and urban telephone networks (GTS) for breathing a new life into wire broadcasting is discussed. The traffic volume and distribution within a service area which determine the wired network structure and the problem of building new aerial and cable wired broadcast lines in an urban setting are outlined and recommendations are given for limiting new cable systems to a specific borough, laying cables in basements of buildings, using existing cable feeders, and increasing the utilization of telephone networks and their facilities. The specific features of wired broadcast network modernization and upgrading are summarized.

### Fiber Optic Communication Line Market: Light and Shadows

927K0325E Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 24-25

[Article by V. Mikhnevich]

[Abstract] The wide gap between the level of fiber optic communication line development in Russia and elsewhere in the world and numerous attempts to bridge this gap are discussed and the first step in this direction—an exhibit and seminar on "Domestic Fiber Optic Transmission Line Component Market" held by the Fiber Optic Technology Association are described. Miniature lasers, photodetectors, optical switches, splitters, multiplexers and demultiplexers, and other optical path elements were exhibited for systems experts. It is noted that despite the high scientific, engineering, and technical

potential of the association, its ultimate success will depend on the demand for its products. The specific problems of operating in a market economy where supply and demand are the dominant price-setting mechanism and the product quality and consumer sophistication play an increasing role are outlined. The marketing problems created by the breakup of the USSR and the difficulties of conversion are summarized and proposals are made for entering the world fiber optic communication system equipment market and being competitive. The need for state support in the face of sophisticated, better equipped, and well financed foreign competitors is stressed.

### **System For Monitoring Radio Broadcast Quality at Decimeter Wavelengths**

927K0325F Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 31-33

[Article by Yu.A. Chernov, O.M. Finyagin, A.V. Vodolazskiy, Ye.I. Zybin, Scientific Research Institute of Radio Broadcasting]

[Abstract] An equipment complex developed by experts from the Scientific Research Institute of Radio Broadcasting (NIIR) which makes it possible to carry out all operations necessary for human and instrumental monitoring of the quality of radio broadcasts and plot the radiation patterns of antennas while circling around the antenna fields as well as from the air is described and monitoring is divided into two categories—on-line and long-term. The new equipment complex is intended for operation within a monitoring network which makes it possible to monitor the noise environment, inform broadcast outlet management about the equipment performance, identify areas with persistently poor broadcast quality, monitor the operation of individual radio stations which require special attention, and help to examine the characteristics of radio link operation as a function of the path geography and ionospheric conditions. The specific monitoring procedures are outlined in detail and the design of the radio broadcast monitoring device (UKR) and its operating principle as well as the procedure for analyzing the monitoring data are summarized. The design of the reception monitoring device (KPU) intended primarily for subjective evaluation of the radio broadcast quality and roughly estimating the signal level, comparing the field strength levels in various channels, and conducting detailed signal strength monitoring of a given station is described. Figures 1; references 1.

### **Telephone Radio Systems for Rural and Suburban Areas**

927K0325G Moscow VESTNIK SVYAZI in Russian  
No 4, Apr 92 pp 34-37

[Article by E.A. Vays, P.G. Kaplunov, I.M. Kotikov, V.E. Chernyy, Persel Company]

[Abstract] The difficulty of providing telephone service to sparsely populated rural areas whose residents are engaged primarily in agriculture due to the considerable distance from one subscriber to another and from the ATX (ATS) as well as the problem of expanding existing services to urban users in suburban residential developments are discussed and an attempt is made to show that digital distribution radio systems with a point-to-multipoint structure are the most suitable for these tasks. A digital cellular system (TsSS) being developed for rural areas and a digital telephone distribution system (TsTRS) being developed for urban telephone networks are described; the TsSS and TsTRS and digital equipment design and operation principle are described and their block diagrams are cited. The specifications of the digital communication distribution systems and their equipment are summarized and the radio equipment design principles are explained. The new systems belong to a new generation of integrated communication facilities which combine elements of switching and transmission systems and are called upon to accelerate the provision of information services to rural areas and residential suburban neighborhoods. The new equipment is tentatively scheduled for implementation in 1993-94. Figures 3; tables 1.

### **Russia is Open to International Cooperation in Communications Field**

927K0324A Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 4-6

[Article by Ye. Borisov, Vestnik svyazi]

[Abstract] The items presented at the Telekom exhibit and the questions and answers at the press conference held on the opening day are summarized; E.K. Pervyshin, the Telekom concern chairman, V.B. Bulgak, the communications minister of the Russian Federation, a *Financial Times* correspondent (England), and V.A. Sudovtsev, the International Telecommunications Union's Russian Service director spoke at the press conference. Mr. Bulgak emphasized that Russia was open to foreign investment and international cooperation and cited the examples of such companies as Samsung, Bell Alcatel, U S West, US Sprint, Nokia, Siemens, NEC, Italtel, Nikola Tesla, and Ericsson. Mr. Pervyshin stressed that the Telekom concern was capable of producing virtually all the necessary equipment for fiber optic communication lines (VOLS) and noted the negative impact of COCOM restrictions on implementing up-to-date high-speed systems; he also stated that COCOM's limitations forced the Russian engineers to produce at home the elements and materials which are otherwise easily available from the West. The problems related to the adoption of the Russian language as one of the six official languages of the International Telecommunications Union (MSE) and the limited volume of Russian language publications (compared to English, Spanish, or French) due to budgetary constraints are mentioned. Proposed changes in the ITU structure and

activities are outlined and the expediency of switching to a single official language (as was done at the Postal Union) is discussed.

#### **Opening of Russia's Communications Workers Insurance Corporation**

927K0324B Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 6-8

[Article by V.A. Zaytsev, Rosastosvyaz Corporation]

[Abstract] The proceedings of an industry-wide symposium held at the end of 1991 which addressed the principal goals, objectives, and activities of the Rosastosvyaz AO—Russia's Communications Workers Insurance Corporation—are summarized. The company activities are aimed primarily at providing insurance services to communications enterprises and organizations with respect to their specific risks as well as to communications workers and their families through Russian Federation Communications Ministry enterprises and organizations. In particular, the symposium dealt with the level of occupational safety and injuries at communications enterprises, existing loss compensation mechanisms, the principal trends of activities in the field of labor legislation, the use of insurance as an indispensable tool for covering risks, the characteristic features of the specialized communications industry insurance operation, and the role of shareholders in company management. For illustration, the sums of lump insurance payments made as a result of work injury is summarized in detail. The insurance corporation bylaws and charter are discussed. Tables 1.

#### **Cooperation With '3M-Lentelefonstroy' Joint Venture: Road to Progress**

927K0324C Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 8-10

[Article by V.I. Maksimov, Svyazstroy Concern]

[Abstract] The increasingly stringent requirements being imposed on the reliability of cable (KLS) and fiber optic communication lines (VOLS) and the important role of cable and fiber splicing and joining in each cable length prompted an investigation of modern splicing and joining practices employed in various countries. With respect to the foregoing, successful cooperation between the 3M company—a leader in the cable splicing technology—and the St. Petersburg Telephone Construction Concern (Lentelefonstroy) which led to a joint venture is described. The joint venture is mainly involved in producing copper cable, joint, and terminal telecommunications equipment developed by the 3M Co. In July 1991, the RSFSR Finance Ministry registered the joint venture as an entity with a foreign investment partner operating in the RSFSR territory. This is the first agreement between a U.S. telecommunications equipment producer and Russia's State Svyazstroy Concern; it was highly praised by the leaders and prominent experts on

both sides. The joint venture is expected not only to produce telecommunications equipment but also train other companies in using it correctly and efficiently. Experts from the 3M Co. and the joint venture held a series of exhibits and seminars aimed at familiarizing instructors in other Russian cities with company equipment and practices. It is speculated that expanding Russian-American cooperation and the development of the new joint venture will help solve the problem of communication network development in the republic.

#### **On Competitiveness of Products Under Market Conditions: Part VI**

927K0324D Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 19-22

[Article by I.L. Kalyuzhnyy, Musson Scientific Production Association, Sevastopol]

[Abstract] The discussion of the competitiveness of communications goods and services which began in *Vestnik svyazi* Nos. 9-12, 1991, and No. 1, 1992 is continued. The need to shorten the production tooling (TPP) phase following the research and development (NIOKR) stage—the two components of the design-to-large-scale-production process—is stressed. The necessary product development cycle (labor outlays vs. time) from the conceptual design to mass production, an interrelated idealized product development flow chart (from a market analysis to product upgrading and R&D outlays for future generations of products out of the operating revenue and profit), and an approximation of the logical s-curve of the product life cycle's discrete function are plotted. The integrated technical and economic indicators (TEP) of an enterprise are derived and an approximate list of resources necessary for production and their controllability are summarized. An algorithm and model of company operation developed for ensuring the science-production cycle functioning under market conditions with a wide range of goods and services under development and in production are described and the profitability conditions are formulated for mastering new products at an enterprise and shortening the development-batch production cycle. Figures 3; tables 1; references 19: 17 Russian, 2 Western.

#### **Computer Graphics in Designing**

927K0324E Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 25-27

[Article by A.M. Bozhko, Yu.N. Kuteynitsyn, State Communication Design Institute, Kiev]

[Abstract] A graphics software package (GPK) developed in 1991 at the Giprosvyaz-3 institute for telecommunications line equipment shops (LATs) which makes it possible to select the equipment configuration and layout and produce a high-quality drawing of the computer-generated design which is stored in computer memory in the form of a digital object model (TsOM) is



described. The PLATs package is designed on the basis of an SM-1420 or SM-4 computer with SM 7316 and SM 6804 (AP 7251 and AP 7252) graphics modules and employs version 3.0 RV operating system or versions 4.0, 4.1, or 4.2 RSX-11M operating system (OS) as well as the GRAF-SM base graphics software. The digital object model can be retrieved from a magnetic medium and subsequently used with other modules. The specific features of developing a digital model of the line shop equipment layout on-line with an operator or in a graphic dialog mode, of developing the layout drawing's computer graphics metafile, of producing a drawing copy on a plotter, and of developing and maintaining the database (BD) are considered in detail. A list of equipment and its position locations is cited and a block diagram of the line equipment shop layout graphics software package algorithm is presented. The new package is intended for use with communications centers and offices and repeaters in a primary network (trunk and area-wide) but may also be used for designing radio center and microwave relay links. Figures 2; tables 1.

#### **Integrated Urban Telecommunications Network Control System**

927K0324F Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 29-31

[Article by Ye.M. Bukreyev, A.D. Shumskikh, Telsib Siberian Telecommunications Enterprise and Girposvyaz-4 Communications Design Institute]

[Abstract] The need for through computer-aided design systems with access to urban telephone network (GTS) automatic control systems (ASUTP) and construction management automatic control systems for comprehensive automation of the urban telephone network design, operation, and construction functions prompted the development of an integrated urban telecommunications network control system. Today, virtually all components of this system are being developed at the SSKTB special communications design office, Minsk branch of the Central Communication Research Institute, and design institutes of the USSR Communications Ministry. The design and operation of the integrated system components—a comprehensive computer-aided communication facility construction control system (KASU), a computer-aided urban telecommunications network process control system (ASUTP GTS), and a computer-aided urban telephone network design systems (SAPR GTS)—is described and block diagrams of the systems are cited. The criteria used in selecting the integrated system hardware and software are outlined allowing for the use of advanced AT microcomputers (PEVM) and computer graphic. The economic advantages of the integrated system implementation are summarized. Figures 3.

#### **Spectral Multiplexing of Fiber Optic Communication Lines**

927K0324G Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 32-33

[Article by Ye.A. Zarkevich, G.P. Dovlatbegov, Central Communications Research Institute]

[Abstract] Spectral multiplexing (SU) of optical line circuits of fiber optic communication lines (VOLS)—one of the most promising ways of increasing the fiber optic transmission line (VOSP) capacity whereby optical signals from several radiation sources operating on different wavelengths are transmitted over a single optical fiber and each signal is modulated by its intelligence message is considered. Block diagrams of fiber optic transmission systems and 2- and 4-channel multiplexers and demultiplexers using diffraction gratings and interference filters are cited. The characteristic features of spectral multiplexing system equipment developed at the Central Communications Research Institute are summarized. The line circuit equipment is intended for digital stream transmission with time-division multiplexing at rates of 1.024, 2.048, and 8.448 Mbit/s. The line circuit equipment shipped to users makes it possible to transmit up to ten digital channels at a 140 Mbit/s rate over one pair of optical fibers or four TV channels. Figures 3.

#### **Marketing for Communications Enterprises**

927K0324H Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 36-38

[Article by M.A. Gorelik, N.V. Rodicheva, MTUSI]

[Abstract] The transition to a market economy in the telecommunications industry calls for using a market-oriented management concept, developing new approaches, restructuring the entire planning and economic activity allowing for the characteristic features of commercial relations, orienting enterprises toward meeting customer demands, and adjusting to competition. In sum, this transition calls for implementing marketing in communication enterprise practices. The concept of marketing as it applies to the industry is defined and interpreted according to P. Kotler and the American Marketing Association (AMA). The role of marketing in the success of a modern enterprise and the principal marketing problems which must be developed to ensure this success are discussed and the experience of a number of enterprises in other countries is reviewed. The role of market research is stressed. The elements of market infrastructure today are examined. The authors are soliciting questions from enterprise managers. References 2: 1 Russian, 1 Western.

#### **Divestment and Privatization in Industry**

927K0324I Moscow VESTNIK SVYAZI in Russian  
No 3, Mar 92 pp 38-39

[Article by V.R. Ivanov, V.P. Klimov, Central Communications Research Institute]

[Abstract] The peculiar features of the telecommunications industry are considered in the framework of the divestment and privatization legislation adopted by the new sovereign states (former union republics); attention is focused on such entities as the consolidated automated communication network (YeASS)—a hierarchical

system with centralized control which interacts with departmental networks and exchanges with access to the statewide switched network. Three approaches to the ongoing public property divestment program and the principal components of the divestment and privatization process in the telecommunications industry are reviewed and a block diagram of the interactions among enterprises with different forms of property in the communication network is cited. A conceptual approach to the divestment and privatization process developed by the Central Communications Research Institute (TsNIIS) and the three property classes of communication enterprises and associations forming in the communication network in the course of divestment and privatization are summarized. The importance of licensing in the privatization and divestment program is stressed and the relevant foreign experience in this field is examined. The need to develop new communications services on a commercial basis so as to enable the emergence of nongovernmental forms of communication enterprise property and creating a healthy competition climate is stressed. To be continued. Figures 1.

#### **Exhibit of Electronic Communication Resources in Geneva**

927K0320A Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 2-5

[Article by: I. V. Kovaleva]

[Abstract] In October 1991 the "Telecom 91" exhibit of the latest achievements in the field of electronic communications was held in Geneva. The most complex and diverse exhibits were presented by countries with advanced technological "know how" in the field of electronic communication (USA, France, Germany) and exhibits by authoritative companies such as Aicatel, AT&T, Siemens, NEC, Nokia, Italtel, Philips, Motorola and also by the international organizations Inmarsat and Intelsat. Among the most popular exhibits were portable cellular telephones and terminals for a multifunctional use developed by integration of the communication devices with computer technology. Fiber optical lines and transmission systems, optical equipment for transition to a new synchronous digital hierarchy transmission speed, which will assure a full utilization of the fiber optics capacity in the near future were well represented. In the area of satellite communication, the entire range of latest developments, which are competing with the optical communication facilities was demonstrated. It included the transmitting and receiving equipment and antennas etc. The most challenging in this area were efforts to develop a global system of satellite communication. The exhibit demonstrated that the fundamental technical problems of ground-based stations are already solved and the designers are now concerned with development of multi-level automated networks of satellite communication (NTT, NEC, MCI).

#### **Modern Modems of Digital Satellite Communication Systems**

927K0320B Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 6-9

[Article by: S. N. Deryugin; UDC 621.396.9]

[Abstract] Fundamental characteristics of the contemporary digital modems demonstrated at the "Telecom 91" International exhibition in Geneva are described and a typical block diagram of the modem functioning is provided. The great interest for modems is the result of the increase of new businesses and computer networks caused by the privatization of the communication facilities in many former Mutual Economic Assistance countries. The modem is also an important element in digital systems of satellite communication. The satellite communication modems exhibited at the "Telecom 91" are basically oriented on the "Intelsat" IBS/IDR and "Evrosat" ESC/SMS standards. Typical features of the contemporary communication modems are their multifunctional capacities; remote control by a standard link-up; availability of digital interfaces for different standards, and a microcomputer for control and display of information; employment of the adaptive differential pulse-code modulation (ADPCM); decoding of the convolution code using the Viterbi algorithm, etc. Figure 5, tables 7, references 6: 2 Russian, 4 Western.

#### **Macroeconomic Model of Communication Efficiency**

927K0320C Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 9-11

[Article by: M. A. Bykhovskiy; UDC 383/384:338.94]

[Abstract] Relationship between the relative Gross National Product and telephone density is used for comparison of the economic efficiency of communications with other branches of the economy. A simple macroeconomic model based on mathematical methods is proposed in this paper. This model reflects functioning of the communications as a branch of the country's economy, and allows for a theoretical determination of this relationship. By optimization of this model parameters it is possible to determine the required share of the GNP needed for development of the communications which would provide a maximal growth of the GNP. The approach, proposed in this paper, can be well used for the development of a comprehensive dynamic model that also accounts for the activity of other various purpose communication networks. With this model it is possible to forecast the efficiency of capital investments in the communication branch of the economy or in the particular sub-divisions for numerous distribution scenarios of these investments. This forecasting can be beneficial for planning the communications development in the country. Figures 4, references 7: 5 Russian, 2 Western.

### Basis for Mutual Accounts in Long-Distance Telephone Communications

927K0320D Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 11-13

[Article by; N. P. Reznikova, T. V. Kormilitsina, G. N. Shamanskiy; UDC 65.9(2.38):621.395]

[Abstract] A method is described for organization of mutual accounting in the long distance telephone communication system between different enterprises. A system analysis theory and experience of international accounting were used as a model for developing the new concept. With this method each individual enterprise of the network can specify its own revenue proportional to the rendered mutual services and can maximize the gains from their primary activity. The interests of each enterprise will be associated with the interests of the entire network as well as with the client's. It will be possible to work out a balance between demands and services, to obtain reliable and objective information about the enterprises' profits, and to adjust the accounting mechanism to the varying economic situations, using prices, the amount of reserve, and other parameters. Further studies are required concerning charges not just for long-distance users, but also for other users of the secondary networks. A system for mutual accounting between enterprises of different sub-divisions of the communication branch must be developed because its "piece-wise" introduction in one sub-division, while retaining an accounting mechanism based on the amount of production in the other, will only make the economic-financial activity more difficult. Figure 1, references 4 Russian.

### High-Efficiency Medium-Wave Antifading Antenna

927K0320E Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 17-20

[Article by; S. P. Belousov, V. N. Demin, A. P. Klochkov; UDC 621.396.679.46]

[Abstract] With antifading antennas it is possible to increase the radiation power, the range of high quality antifading reception of surface waves at night, and to employ more rationally the allotted radio frequencies. In this paper the results are described of a theoretical and experimental study of a four-sectional antifading antenna with a regulated current distribution fed at two points. The antenna is tuned by installing crosspieces between the wire cylinders of the antenna and its mast. The construction of this type of antenna is simple and is recommended when a long time operation on a particular wavelength is planned. The theoretical and experimental studies with an antenna model in the decimeter range indicate that the four-sectional antenna with an optimal antenna pattern exhibits a significant gain, compared to other antennas, as well as antifading properties in a wide frequency range. Employment of this type of antenna will significantly expand the range of high

quality reception of radio broadcast. If required, the operating wavelength of the antenna can be expediently changed within 240 - (510-550)m. Figure 8, references 3 Russian.

### Antenna for TV Broadcasting in Adjoining Frequency Channels

927K0320F Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 20-23

[Article by; Yu. N. Nosov; UDC 621.396.677.49]

[Abstract] Feasibility of designing non-directional in the horizontal plane antennas capable of transmitting signals from several transmitters without limitations on minimal separation of the operating frequencies. Experimental results were obtained with an antenna model for operation in the 65-108MHz frequency range. The antenna was made of two tiers of identical radiators (four radiators in each tier) located in a vertical prism with a  $2.54 \times 2.54 \text{ m}_2$  cross section. The radiator consisted of two horizontal oscillators  $0.9 \text{ A}_{\text{min}}$  long which are parallel to each other. The experimental results support feasibility of developing a wide-band transmitting antenna with several mutually decoupled inputs. When activated, a near-circular antenna pattern is formed in the horizontal plane. The operating frequencies of the transmitters can be transmitted through a single, adjacent or non-adjacent frequency channels. This type of antenna can replace two or three single-input antenna. This would significantly save the space on the antenna tower. Figures 12, references 6 Russian.

### Waveguide Channel for Low-Capacity Radio-Relay Lines in 2GHz Frequency Range

927K0320G Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 23-25

[Article by; A. A. Metrikin; UDC 621.396.677.83]

[Abstract] The transmitting capacity of radio-relay lines can be increased by using circular waveguides of an appropriate diameter. Since waveguides of this kind are not available, the author of this paper proposes using standard pipes of aluminum alloy and describes the results of the experimental study. Using D135 pipes made of aluminum alloy type 1925, manufactured in accordance with the GOST 18482-79 and operating in the 2GHz frequency range it was possible to transmit signals with small energy losses and with a low level of transient noise. The experimental data of the line's attenuation and other parameters are provided. The employment of the D135 pipes is particularly advantageous when they are also used for the construction of towers. The manufacturing accuracy of the pipes determine how close their electrical parameters will agree with the experimental. Figures 6, references 6 Russian.



**Directivity Improvement of Broadside Array Antenna in the Decimeter Range by Employment of Passive Dipoles**

927K0320H Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 28-29

[Article by; Yu. V. Pimenov, A. V. Yampolskiy; UDC 621.396.677.83]

[Abstract] The broadside antennas consist of a linear array of  $n$ -symmetrical oscillators arranged parallel to the ground surface. Normally, this kind antennas are used as transmitters in communications or broadcasting systems. This paper describes how to significantly increase the antenna efficiency and to reduce the level of side radiation by installing a chain of passive oscillators between the antenna oscillators and the ground. The analysis of currents in the antenna's oscillators was made by applying the generalized induced emf method. The computations indicate that for  $0.03\lambda$  thick cylindrical oscillators the current's inphase condition in the passive and active oscillators of the antenna at  $\Lambda=\Lambda_0$  is provided in the case of  $t=0.36\Lambda_0$ , and remains so throughout the entire operating range. It was also shown that the gain from using the passive oscillators does not depend much on their number in the antenna tier. Figures 6, references 2 Russian.

**Family of Compatible Methods for Coding TV Images for Digital Transmission Systems**

927K0320I Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 29-32

[Article by; V. Yu. Yepanechnikov; UDC 621.397.132.037.372]

[Abstract] Many problems may arise with implementation of the component analog and digital form of signal transmission and the expected transition to a new scanning standards in the near future. One of these problems is transmission of wideband signals in an analog and digital form using the existing communication channels. In this paper the results are described of studies on development of a family of compatible methods for an effective coding of color TV pictures with a 625 lines scanning standard for transmission at the rate of 15, 30, 65 and 125 Mbit/s. With this coding method it is possible to standardize the hardware and to reduce the digital flow of TV images from 140 to 17 Mbit/sec. Test of the qualitative characteristics of the adaptive group coding algorithm components at some "control points" of the transmission rate of color TV signals indicate that the characteristic of the modified coding algorithms are not inferior to the characteristics described in the CCIR Rec. 721 and 723 for identical transmission rates of the video signal. Figure 4, references 10: 5 Russian, 5 Western.

**Methods for Measuring the Articulation and Quality of Synthesized Voice**

927K0320J Moscow ELEKTROSVYAZ in Russian  
No 6, Jun 92 pp 35-38

[Article by; V. G. Mikhaylov; UDC 621.395]

[Abstract] When developing voice communication devices containing vocoders, the estimates of the voice transmission quality remains a pressing problem. The existing measuring methods do not fully take into account the specific features of synthesized speech for obtaining adequate estimates of the quality and intelligibility of the vocoder communication. Based on linguistic analysis of the problem, methods are proposed in this paper for measuring the intelligibility and quality of voice transmission as well as for recognition of the speaker by his voice. A large volume of synthesized speech records was used for testing the developed methods, which subsequently were approved by many organizations. Further improvement of the proposed methods will help to develop a standard approach to estimating the transmission quality focused on automation of the measuring procedure using personal computers. Figure 6, references 11.

**Videoconferencing: New Business Communication Technology**

927K0319A Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 2-4

[Article by M.A. Smirnov, G.Ye. Itkis; UDC 621.395.9]

[Abstract] The prominent role of videoconferencing (VKS) in facilitating business contacts worldwide is noted and the design principles and utilization characteristics of videoconferencing systems are considered; in particular, the peculiar features of videoconferencing and its advantages over other types of communication, the videoconferencing studio equipment, the design and operation of the videoconferencing codes, the peculiarities of international video conferences, the videoconferencing system development outlook, and the videoconferencing system operating experience are examined in detail. The advantages of videoconferencing are presented as the ability to save time, comprehensively exchange information, and make prompt decisions. Figures 3.

**Television Outlook: Discussion**

927K0319B Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 5-7

[Article by S.V. Novakovskiy; UDC 654.197.316.77]

[Abstract] The role of TV broadcasting and dedicated television in a developed society with a powerful economic-technical base with a constantly increasing role of information and automation is discussed and an attempt is made to predict the role of television in the early

twenty-first century when mankind enters the age of universal "television" and computerization. The expected role of television systems used to control the national economy (TS UNKh), including the local close-circuit dedicated TV systems (ZLS) and large TV control systems (BSTU), TV information reference systems (SSTI) already in operation in Britain and France, and mass-scale TV information systems (MTI), i.e., broadcasting and video recording, are considered in detail. An analysis shows that the role of TV control, information, reference, and broadcasting services is continuing to rise, making it necessary to increase the output of new color TV sets for business and entertainment purposes to 16-20 million sets a year. References 9.

#### **Packet Radio Communication Network Using Meteor Channels**

927K0319C Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 9-11

[Article by V.V. Bolshakov, N.V. Kletskiy; UDC 621.396.22]

[Abstract] The development of meteor burst radio communication since the 1960's is reviewed and the shortcomings of this method, e.g., the intermittent nature of the resulting channels which limits the channel capacity and message timeliness are discussed. It is stressed that the emergence of microprocessor systems made it possible to control such channels which are characterized by a long range of VHF-UHF radio links, depend little on ionospheric disturbances, are secure and noise immune, use a narrow bandwidth, and are quite efficient economically. A specific packet communication network based on meteor bursts is considered and the results of path tests and computer simulation are presented. The meteor burst channel equipment is described and a model of a meteor packet communication network is analyzed. The channel error rate, the mean channel waiting time, and the mean channel life are summarized. The conclusion is drawn that a meteor burst network can be developed pursuant to CCITT (MKKTT) Recommendation X.25, making it fully compatible with other data transmission networks and suitable for use as a subsystem in more extensive networks. The meteor communication network architecture is simple and economical and can utilize the packet switching principle. The limit of input load is currently equal to 7 packets per minute or 100-120 ASCII characters per minute but is expected to increase in the near future. Figures 5; tables 2; references 6: 5 Russian, 1 Western.

#### **Certain Aspects of Fiber Optic Transmission System Development**

927K0319D Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 12-13

[Article by Yu.K. Rudov, I.A. Lukin, Yu.V. Svetikov; UDC 621.396.2:681.7]

[Abstract] A steady trend toward digitization and fiber optic cable (OK) and fiber optic transmission system (VOSP) utilization which characterizes the development of communication networks, particularly the new trans-Siberian fiber optic line (soon to become a part of the Global Digital Communications Ring) with a 565 Mbit/s transmission rate, is discussed and the issue of developing up-to-date fiber optic transmission systems on the basis of optical data generation, processing, storage, display, and switching methods are addressed. The principal development trends, the fiber optic transmission network design, the fiber optic transmission system equipment, and the promising trends and outlook are considered in detail. The role of the Sopka-5 quinary system and Sopka-4 and Sopka-4M quaternary systems in the trans-Siberian line (TSL) is analyzed and it is noted that in the near future, the TSL transmission rate will be increased to 2.5 Gbit/s. It is stressed that scientific and technical tasks of developing faster transmission and switching systems using purely optical methods must be addressed in order to provide users with all types of conceivable information and communication services. References 15: 4 Russian, 11 Western.

#### **Unified VOSP-480M Single-Mode Optical Cable Transmission Equipment**

927K0319E Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 14-16

[Article by Yu.A. Zingerenko, M.A. Plotkin; UDC 621.396.2.099.1]

[Abstract] The transition from multimode to single-mode fiber optic cables (VOK) operating at a 1.3 and 1.55  $\mu\text{m}$  wavelength which have a much wider bandwidth and lower losses prompted the development of new area-wide fiber optic transmission equipment to replace existing VOSP-120/480 systems; the new VOSP-480M equipment is capable of providing a service communication channel and an audio frequency channel over the optical fiber cable's metal conductor. The principal specifications, criteria for selecting the type of line signal and service subsystems, principal components, intelligence and service signal receiving and transmitting equipment, and specialized instrumentation of the VOSP-480M system are described in detail. The data transmission rate is 34.368 Mbit/s, making it possible to derive 480 audio frequency channels by the pulse-code modulation method; the maximum line circuit length is 600 km. The use of the new equipment makes it possible to decrease the number of manned and unmanned repeater stations and thus lower capital outlays and operating costs. The equipment design is unified for both wavelengths and operating frequencies can be switched by replacing a board in the transmitter section. Figures 4; tables 1; references 3.

### **Quinary Fiber Optic Transmission System Equipment Complex**

927K0319F Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 17-18

[Article by I.A. Lukin, M.I. Belyakov, S.F. Lebedev, V.D. Liferenko, Yu.V. Markov; UDC 621.396.2.029.7]

[Abstract] The urgency of implementing fiber optic transmission systems operating at a rate of 565 Mbit/s and employing a single-mode optical cable is stressed and a complex of such quinary equipment operating at a 1.3  $\mu\text{m}$  wavelength over a 30 km repeater leg (RU) and 1.55  $\mu\text{m}$  over a 100 km repeater leg is described. Pursuant to CCITT recommendation G.956, the digital line signal (TsLS) of this quinary system is formed by combining four asynchronous quaternary digital streams. The use of the 10B1P1R line code makes it possible to develop line equipment operating at a 140 Mbit/s transmission rate; after multiplexing the four 167.107 Mbit/s streams in the 10B1P1R code, a line signal of the quinary fiber optic transmission system is formed and does not call for subsequent digital processing. A block diagram of the equipment is cited. It is speculated that the line plant complex of the trans-Siberian line (TSL) between Moscow and Nakhodka will be built on the basis of this equipment. The system can be built using the domestic component base. The system employs a single line signal forming algorithm which makes it possible to realize equipment at higher hierarchy levels. Figures 4; references 4: 1 Russian, 3 Western.

### **Digital Fiber Optic Trunks for Cable TV Systems**

927K0319G Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 19-22

[Article by S.S. Kogan, L.Kh. Nurmukhamedov, V.M. Solovyev; UDC 621.397.23]

[Abstract] The history of the TV trunk development on the basis of both digital and analog signal transmission methods is reviewed and the design and architecture principles of the STVOL-"Tsifra" (STVOL-1) and STVOL-"Tsifra-2" (STVOL-2) fiber optic TV trunks specifically developed for use in urban cable TV networks are considered. Two design principles of cable TV networks (SKV), the tree-and-branch and hub-and-spoke, are outlined. The design and operating principles of the STVOL-1 and STVOL-2 equipment are described; the former uses a single multimode graded-index fiber over a distance of 25-30 km while the latter—over a single single-mode optical fiber of up to 30 km long. The block diagrams and principal parameters of the STVOL systems are presented and compared to those of the TsSL-TV and Sopka equipment. The STVOL systems ensure a high and stable quality of signals received from studios and satellite earth stations as well as other sources for subsequent distribution to the local neighborhood network. The STVOL equipment uses standard digital stream rates, making it possible to access other fiber optic communication systems and

bring fiber optic transmission systems closer to data users. The composite color signal is directly encoded in the equipment without additional processing; this approach makes it possible to simplify the equipment and lower its cost. Figures 7; tables 3; references 5.

### **NRZ-L Signal Regenerator for 668 Mbit/s Transmission Rate**

927K0319H Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 22-24

[Article by S.F. Lebedev, V.D. Liferenko, I.A. Lukin, Yu.V. Markov, V.V. Molkin; UDC 621.376.56]

[Abstract] A fifth hierarchy order NRZ-L signal regenerator for a 668 Mbit/s rate (4x167 Mbit/s) using the 10B1P1R code employing a new clock frequency discriminator (VTCh) which minimizes phase jitter accumulation in the regenerator network is described and a block diagram of the regenerator's electrical section is cited. The regenerator is developed with solid state low-scale integration circuits (MIS) developed on the basis of SST technology, making it possible to improve its performance, especially reliability and energy consumption, while meeting the necessary specifications. The principal parameters of low scale integration transistors are summarized; the quinary regenerator uses +5 V and -5.2 V power supply sources and its power demand does not exceed 1.9 W. The wide-band amplifiers-limiters (ShPU) have a 63 dB gain within a 100-1,300 MHz band, a low amplitude-phase conversion (AFK) with a wide dynamic range, and stable phase characteristics within a temperature range from -20°C to +60°C. The master-slave D-flip-flop has a 1,300 MHz timing frequency limit. The regenerator has successfully passed plant tests for use in the trans-Siberian fiber optic line. Figures 2; tables 2; references 6: 1 Russian, 5 Western.

### **Optical Cable Line Operation Experience**

927K0319I Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 24-26

[Article by Ye.G. Kolesnikova, V.L. Krupina, Ye.V. Pintsev; UDC 621.372]

[Abstract] The operating experience of optical cable lines, particularly the causes of the failures and malfunctions developing during the fiber optic communication line operation is summarized and data on the behavior of line parameters under natural environmental conditions are accumulated in order to increase the operating reliability of optical cable links. For illustration, data obtained during pilot operation of optical cable links (OKL) in a local fiber optic data transmission network built in 1985-1988 and consisting of 12 optical cable links of varying length buried underground or laid in cable ducts are analyzed for the first time for an extensive domestic communication network with more than 30 km of cable. The study shows that cable links with the



OK-SS01 cable ensure a low splice attenuation of about 0.22 dB and line attenuation stability both underground and in cable ducts. It is noted that reliable optical cable network operation calls for increasing the cable's  $\gamma$ -percentile life by two orders of magnitude. An analysis reveals that the optical cable line's weakest link is the nondetachable optical fiber joints which were responsible for three out of the four failures which occurred in 1985-1988. Figures 3; tables 3; references 7.

#### **Optical Signal Processing Methods: Base of Future Fiber Optic Systems**

927K0319J Moscow ELEKTROSVYAZ in Russian  
No 5, May 92 pp 27-29

[Article by V.I. Makkaveyev, Yu.V. Svetikov; UDC 621.391.032.372]

[Abstract] The fully optical signal processing methods being actively developed today for use in prospective fiber optic transmission systems are discussed and the possibilities of realizing the basic functional operations which characterize the digital transmission and switching system equipment on the basis of purely optical signal generation and processing methods are considered. Attention is focused on the signal processing utilization trends in fiber optic transmission system equipment and an analysis of the effect of crosstalk interference on optical data processing systems. For illustration, examples of devices with optical signal processing in fiber optic transmission systems are examined and a block diagram of a fiber optic transmission system with optical signal processing is cited. Optical transmission lines (OLP) and functional signal processing devices on their basis are classified. The need for a coordinated and concerted research effort aimed at developing more complex optical functional devices for use in transmission and communication network control equipment is stressed. The advantages of purely optical signal processing methods over electronic at superhigh transmission rates (of up to hundreds gigabit per second) and for such devices and fiber-to-home systems are summarized. Figures 1; tables 1; references 12: 7 Russian, 5 Western.

#### **Strategy of Decreasing Losses and Improving Electric Power Quality in Electric Networks**

927K0314A Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 6-12

[Article by Yu.S. Zhelezko; UDC 621.311.1.017.2.001.1]

[Abstract] The interrelation between reducing the losses and improving the quality of electric power in networks in order to save fuel and energy and the common features of these two problems are discussed; it is noted that in 1990, Energy Ministry's power networks lost 133.8 billion kWh. The electric power consumption in several branches of the industry is analyzed and it is shown that total losses in the Energy Ministry networks are commensurate with the useful electric power demand

of the most energy-intensive industries in the country. The optimal losses and comparative efficiency of the measures aimed at lowering them, the required volume of compensating device production (KU), the strategy for compensating device implementation in electric power and user networks, the commercial and technical systems analysis tasks of optimum reactive power compensation (KRM), a system of financial incentives for power system staff for reducing energy losses, and a strategy of improving the electric power quality (KE) are considered in detail. A block diagram of the regulatory, methodological, and software support of a system for reactive power compensation and electric power quality improvement and the structure of electric power losses are cited. The importance of economic sanctions against the users who bring down the quality of electric power is discussed. Figures 2; tables 3; references 18.

#### **Induction Motors With Multiplanar Structure of Electrical-Sheet Steel Layers**

927K0314B Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 26-31

[Article by A.A. Stavinskiy; UDC 621.313.333: 669.14.018.5]

[Abstract] The importance of lowering the energy and metal consumption of induction motor (AD) production and lessening the effect of the thermal and mechanical factors which accelerate the aging of winding insulation is noted and several ways of reducing the electric-sheet steel waste while maintaining traditional production methods, particularly by approximating the external magnetic circuit loop to the optimum shape, are discussed. It is suggested that the surface of the faceted magnetic circuit be complemented to the cylindrical shape using compacted ferromagnetic straps. The task of developing classic induction motors which meet modern requirements is solved by using magnetic circuits from spatial multiplanar electric-sheet steel layers which include a planar serrated layer and a circular part of the yoke with the polyhedral external loop configuration. The geometrical relations between the yoke elements are plotted and derived and the elementary layer blank design as well as the configuration versions and elementary layer punch waste are considered. The conclusion is drawn that the eight-sided elementary layer polyhedron configuration is the most economical for induction motors with a multiplanar magnetic circuit. It is shown that in addition to lowering the silicon steel and structural material waste, multiplanar magnetic circuits increase the external cooling surface area. The study also demonstrates that the development of such motors is one of the ways of solving the problem of general resource conservation in electrical engineering and does not call for radical retooling or for developing a wide range of new production equipment. Figures 4; references 8: 7 Russian, 1 Western.

### **Magnetic System Analysis of Magnetic Fluid Seals**

927K0314C Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 36-41

[Article by D.V. Orlov, S.M. Perminov; UDC 621.312.044.001.57:538.4]

[Abstract] Practical applications of magnetic fluids (MZh)—stable colloidal suspensions of superdisperse ferro- and ferrimagnetic particles with a 15 nm size in a carrier medium are discussed and one of the most efficient uses of such liquids in magnetic fluid seals (MZhG) for rotary junctions in the United States, Japan, Great Britain and other countries is outlined. A steady trend toward expanding the magnetic fluid seal uses prompted the tasks of their analysis and design optimization. The analysis duration and accuracy are checked by studying the field in the working zone of a magnetic fluid seal using its physical model made from the same materials; the assumptions made in the field analysis using the magnetic circuits theory method (MMTs) are outlined. The magnetic fluid seal design, the magnetic flux distribution, the working zone conduction distribution pattern and its equivalent circuit, and the leakage flux area and boundary conditions are considered. The analytical procedure is checked on a magnetic fluid seal model which makes it possible to measure the flux in the neutral cross section of the magnet and a number of leakage flux components by the ballistic method; despite a certain discrepancy between the experimental and theoretical data for individual leakage flux components, it does not exceed 4 percent. The method's reliability is also confirmed by testing a large number of magnetic fluid seals. One analysis on a YeS 1060 computer takes several seconds and produces accurate results, making it possible to use the method as a mathematical model for developing the optimization algorithm. Figures 7; references 14: 12 Russian, 2 Western.

### **Microelectronics Circuit-Based Symmetric Component Filters**

927K0314D Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 46-49

[Article by V.U. Kizilov; UDC 621.316.925:621.372.54.001.24]

[Abstract] The constraints on using symmetric component filters (FSS) due to the limited range of relay protection devices despite the high information content value of the symmetric current, voltage, and power components and the expanding uses of symmetric component filters are noted and it is stressed that despite the fact that the use of microelectronics device in symmetric component filters makes it possible to eliminate the effect of load measurements, such devices are still being underutilized. A negative phase sequence symmetric component filter is considered since there is no principal difference between the negative and positive phase

sequence devices; a symmetric component filter consisting of two 60° phase shifting devices (FSDU) is examined for illustration. It is demonstrated that a symmetric component filter can be designed on the basis of a single phase shifter with an arbitrary phase shift angle of one line voltage. A design of a negative phase sequence symmetric component filter (FSSOPN) with a 90° angle with a single transformer and one operational amplifier (OU) which also serves as a compensator is analyzed. The study reveals that a symmetric component filter with an operational amplifier has a low error contributed by the intervening current and voltage transformers; a precision phase shifter makes it possible to realize accurate symmetric component filters with a 0.1-0.2 percent error. The possibility of designing twinned and combined symmetric component filters on the basis of negative or positive phase sequence devices without additional phase shifters is demonstrated. Figures 7; references 10.

### **Selection of Design Single-Phase Fault for Determining Relay Protection Current Circuit Wire Cross Section**

927K0314E Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 50-53

[Article by Ya.M. Kanevskiy, Ukrainian Branch of All-Union Scientific Research and Design Institute of Power Industry; UDC 621.316.925.2:621.314.224.064.1.001.24]

[Abstract] The design conditions for selecting the permissible loads on the current transformer (TT) windings which feed the current circuits of relay protection devices under a single-phase short circuit (k.z.) are considered in order to facilitate the pilot cable conductor cross section selection. In so doing, expressions are derived for comparing the single-phase fault currents in 100-220 kV network branches with solidly grounded neutral conductors and the design burdens under two- and single-sided feed to the fault in network elements in order to calculate the pilot cable conductor cross sections in relay protection current circuits in the case of the Y- and delta current transformer circuit connections. The dependence of the primary current ratios of the fault phase and the fault-to-earth current for varying inductive reactance and current distribution coefficient ratios in the network and the dependence of the circuit coefficient—the variables which take into account the current ratios in the relay and secondary current transformer currents—on the current distribution coefficient ratio for a single-phase fault are plotted. Figures 5; tables 1; references 4.

### **On Assessing Voltage Quality in Three-Phase Systems**

927K0314F Moscow ELEKTRICHESTVO in Russian  
No 5, May 92 pp 53-56

[Article by D.V. Vilesov, A.Ye. Bondarenko; UDC 621.316.1.016.4.015]

[Abstract] Expressions are derived for the instantaneous values of the phase voltage in a three-phase electric system with a perfect voltage quality in order to compare them to the actual phase voltage and thus assess the voltage quality in the system. For convenience's sake, relative units are used in the calculation. A block diagram of the circuit for determining the absolute value of the voltage representation vector (IVN) of a three-phase system is cited and the patterns of the IVN magnitude

behavior are plotted. The study shows that the main voltage quality indicators in a three-phase system in steady-state and transient conditions can be determined with the help of the IVN vector modulus while the auxiliary function is rather simple and can be determined accurately in an experiment. The absolute value of the voltage representation vector can be used in instruments for assessing the voltage quality and in control and regulating devices. Figures 4; references 2.



### Possible Causes of Prolonged Electromechanical Oscillations in Power Grid

927K0315A Moscow ELEKTRICHESTVO in Russian  
No 6, Jun 92 (manuscript received 29 Oct 91) pp 13-17

[Article by I.V. Likens, N.G. Filippova, and S.G. Otmorskiy]

[Abstract] An analysis of prolonged electromechanical oscillations in an integrated power system was made for a determination of their possible causes. As a typical such system was selected the Southern Power Grid covering many regions where ELF oscillations ( $f \approx 0.4$  Hz) had occurred during the 1988-89 period. Calculations were made for the European part of that grid which covers a large territory and includes one nuclear power plant. It consists of 52 nodes (generating plants: 15 with "infinite power" busbars, 1 equalizer) and 66 branches (330 kV and 750 kV transmission lines). The calculations were made by the method developed at the Moscow Institute of Power Engineering and consisting of three stages. First, on the basis of field test data, were calculated steady-state operating and three calculation schemes selected for subsequent analysis of: 1) initial pre-fault conditions, 2a) post-fault conditions with all nuclear reactors in that power plant shut down, 2b) post-fault conditions with only nuclear reactors feeding the 750 kV lines shut down. In the second stage was analyzed the static stability of oscillations, including calculation of the periodically varying stability limits. In the third stage were determined the intrinsic dynamic characteristics of the power system. The results of this study indicate that equipping all generators with heavy-duty automatic voltage regulators will ensure static stability of a power system and will greatly improve the damping of natural electromechanical oscillations in the power system. They also indicate that the SDPI automatic voltage regulators installed in this grid with standard setting ensure static stability under pre-fault conditions only and that ensuring it under post-fault conditions requires stabilization of their gain ( $K_{OP}$ ,  $K_{PI}$ ) above the standard setting. They do not improve the damping of the dominant system oscillation mode (frequency  $f_1 \approx 0.4$  Hz, damping factor  $\alpha_1 = 0.003-0.01$  s<sup>-1</sup>) under pre-fault conditions and even weaken its damping under post-fault conditions even with higher than standard  $K_{OP}$ ,  $K_{PI}$  gain setting, the reason being that relevant system requirements had not been considered in their selection for the job. With respect to the second system oscillation mode ( $f_2 = 0.7$  Hz), the power system appears to be divided into groups of generators oscillating in phase opposition with large amplitudes and weak damping ( $\alpha_2 = 0.08-0.12$  s<sup>-1</sup>). Figures 4; tables 1; references 5.

### Design Parameters of Inductive Energy Storage for Power System

927K0315B Moscow ELEKTRICHESTVO in Russian  
No 6, Jun 92 (manuscript received 12 Mar 91) pp 18-24

[Article by I.V. Yakimets, candidate of technical sciences, V.G. Narovlyanskiy, candidate of technical sciences, and V.M. Matveykin, engineer, Institute of Power Engineering imeni G.M. Krzhizhanovskiy]

[Abstract] The design of an inductive energy storage for a power system is outlined, specifically for a power system serving the petrochemical industry. The requirements are that it deliver pulsed active power of constant magnitude and damp fluctuations of active power with minimum expenditure of reactive power while it absorbs reactive power over long periods of time, as may be necessary for maintaining stability of large synchronous loads in such a power system. The storage device is to be connected to the power system through a six-phase inverter-rectifier with a three-phase equalizing reactor and three controlled buffer diodes in addition to the six controlled phase diodes, for two-parametric (kW, kvar) control of the storage device and flexible timing of the energy buildup-storage-delivery cycle. The design procedure is based on applicable current-voltage-phase and power relations according to electrical circuit theory, the inductance coil and the inverter-rectifier with interdependent characteristics being treated as one design object. A performance analysis and numerical estimates validate the design procedure. Figures 7; references 10.

### Modeling Process of Pulsed Magnetization Reversal in Laminated Magnetic Structure

927K0315C Moscow ELEKTRICHESTVO in Russian  
No 6, Jun 92 (manuscript received 13 Aug 91) pp 34-39

[Article by S.Ye. Zirka, candidate of technical sciences, and Yu.I. Moroz, candidate of technical sciences, Dnepropetrovsk State University]

[Abstract] A mathematical model is constructed to describe pulsed magnetization reversal in a magnetic structure consisting of laminations cut from up to 0.28 mm thick sheet of electrical transformer steel, this material having a hysteresis loop which is not square so that eddy currents are the dominant effect and magnetic viscosity is negligible. As an example of such a structure is considered a toroidal core with an  $\alpha = OD/ID$  ratio of outside to inside diameters which has been formed by winding  $n$  layers of sheet tape (thickness  $\delta$ , width  $b$ ), its cross-sectional area thus being  $S = nb\delta$ . Such a core is regarded as a stack of  $K$  cylinders (height  $b$ ) one around another, the width of each being  $c = n\delta/K = (D_{ko} - D_{ki})/2$  wide ( $D_{ko, ki}$  - outside and inside diameters of  $k$ -th cylinder,  $k = [1, K]$ ) and each cylinder consisting of closed collars (thickness  $\delta$ ) one around another (length of each tape bent into a collar for the  $k$ -th cylinder  $L_k = \pi(D_{ko} - D_{ki})/2$ ). Inasmuch as tapes have usually a thickness  $\delta$  much smaller than their width  $b$  and length  $L$ , describing the magnetization of such a cylinder requires integration of two one-dimensional Maxwell's field equations relating instantaneous magnetic induction  $B$ , magnetic field intensity  $H$ , and electric field intensity  $E$  for a rolled sheet of a material with an electric conductivity  $\sigma$  and a magnetic permeability  $\mu = f(H)$ . With the substitution  $B = \mu H$ , these two equations yield the wave equation for a plane electromagnetic wave penetrating the sheet ( $x$  - coordinate normal to sheet surface,  $z$  - coordinate in direction of rolling). The partial second space derivative  $\partial^2/\partial x^2$  in this equation is then replaced with a difference

scheme which approximates it with  $h^2$ -order precision and reduces the equation to a system of  $N$  ordinary nonlinear differential ones for the time derivative  $dH/dt$ , the latter then also being replaced with a difference scheme which linearizes the magnetization reversal problem. This system is solved for  $H_i$  in the nodes of a uniform  $x_i$  grid ( $i = [1, N]$ ) in steps  $h = \delta/[2(N-1)]$ . Following an outline of the calculation procedure and its application to magnetization reversal in a saturable material generally, it is applied to a large generator-load matching pulse transformer built with 0.15 mm thick laminations of grade-3425 electrical steel ( $\sigma = 2$  MS/m). The results of its performance analysis based on the equivalent circuit with a square-pulse voltage source can be useful for its design optimization: minimum size and weight combined with maximum increment of magnetic induction within the duration of a voltage pulse so that the partial hysteresis cycles will approach the major loop as closely as possible. Figures 3; references 7.

#### **Longitudinal Impedances of Shielded Multiconductor Cable With Outside Conductors**

927K0315D Moscow ELEKTRICHESTVO in Russian  
No 6, Jun 92 (manuscript received 13 Nov 91) pp 39-49

[Article by B.M. Fradkin (deceased), Moscow Institute of Power Engineering]

[Abstract] The longitudinal partial impedances of a multiconductor cable with a shield of finite thickness separating any number  $N_i$  of conductors inside it from any number  $N_o$  of conductors outside are calculated by taking into account both skin and proximity effects. The equations for the currents in such a cable are formulated in accordance with Kirchhoff's first law, with boundary conditions of equal vector potentials and equal tangential magnetic field components at the surface of each conductor. The number of constant coefficients is then reduced on the basis of their interrelations, whereupon a system of field equations is formulated describing the field around each conductor (and shield) as a superposition of three fields set up respectively by: 1) the current

in the given conductor, 2) the current in the nearest neighboring conductor, 3) the currents in the remaining inside and all outside conductors including the shield. This system of equations contains all coefficients which determine the distribution of the vector potential over the cable conductors. They can be expressed through the zeroth-order terms in the series expansion of the vector potential. On the basis of Ohm's law and considering that the difference of vector potentials is determined solely by those zeroth-order terms, expressions are then obtained for: 1) the self-impedance of one inside conductor and of one outside conductor; 2) the mutual impedance with a second conductor on the same side and with a second conductor on the other side. Figures 1; references 3.

#### **Potential and Current Distributions in Metal Grid With Rectangular Cells**

927K0315E Moscow ELEKTRICHESTVO in Russian  
No 6, Jun 92 (manuscript received 25 Oct 91) pp 59-64

[Article by A.A. Meyer, Moscow]

[Abstract] A rectangular plane metal grid of arbitrary dimensions with either grounded or free edges and with rectangular cells is considered in a Cartesian system of coordinates with the origin 0 at one corner and the  $x, y$  axes along the two adjacent sides respectively, the electrical resistance of intersecting conductors being different:  $R_n$  of conductors parallel to the  $x$ -axis and  $R_k$  of conductors parallel to  $y$ -axis. A system of  $(N-1)(K-1)$  equations for  $(N+1)(K+1)$  values of the potential  $\Phi(n, k)$  at each node, the left-hand side being equal to 1 for the corner node ( $n_0, k_0$ ) and 0 for all the other nodes in compliance with Kirchhoff's voltage law around any loop. This system of equations fully describes the electrical state of a grid with a single current source. It is solved by representing the potential as a product of two functions  $\Phi(n, k) = X(n)Y(k)$  and then separating the two variables. It is solved by this method for a grid with grounded edges and for one with free edges, a consistent solution for the latter case requiring insertion of a second current source of opposite polarity into the grid. References 3.

**New Equipment for Automation of Thermal and Chemo-Thermal Processing in Controlled Atmosphere**

927K0302C Moscow ELEKTROTEKHNIKA in Russian  
No 2, Feb 92 pp 8-10

[Article by; V. D. Artemyev, V. S. Poloyko, candidates of technical sciences, N. N. Stolyarov, R. S. Stankevich, A. V. Tsukerman, engineers; UDC 621.36.002.5]

[Abstract] The Scientific Production Association "Elektroterm" and the Production Association "Analitpribor" develop, manufacture and promote adaptation of systems for measurement and automatic regulation of the carbon potential or concentration of the carbon dioxide in the atmosphere of ovens for gas grouting, citra grouting, hardening, caking, etc. The systems are equipped with infrared CO<sub>2</sub> sensors and also with specialized computers for computing the carbon potential. A solid electrolyte carbon potential sensor is also manufactured and its use with industry is promoted. The fundamental technical parameters of the sensor are listed in this paper. Figures 3.

**Spatial Dynamics of Local Irradiation**

927K0302D Moscow ELEKTROTEKHNIKA in Russian  
No 2, Feb 92 pp 15-17

[Article by; A. V. Arendarchuk, candidate of technical sciences, VNIETO; UDC 535.683.001.5]

[Abstract] Local optical irradiation is an important contribution in providing a comfortable and economical artificial environment for men in every day life, at working places, medicine, etc. The utilization efficiency of this procedure is determined by the availability of controlled irradiation systems. Problems are examined in this paper related to the development of automatic irradiation systems intended for generation of dynamic irradiation fields in artificial environment. Two systems are discussed: a system which follows the irradiation object, and the system which is adaptive to the shape and position of the object. In the contemporary medical practice the spatial dynamics of the irradiation systems can be used for treating some parts of the human body of arbitrary shape under non-stationary conditions. The development of the adaptive irradiation concepts must be guided by the following principles: Adaptation in a broad meaning i.e. a design of a system provided with sensors for obtaining information about the object of irradiation, and generation of the irradiation field with structurally redundant, spatially distributed, controlled irradiation sources. At the present time the development of the spatial dynamics concepts in application with local irradiation is held back by unavailability of a servo device—ocular-motor, which is a functional analog of the manipulator of an industrial robot. Figures 1, references 5 Russian.

**Current-Conducting Arms of Electrode Holders for Electric Arc Steel-Melting and Ladle Furnaces**

927K0302E Moscow ELEKTROTEKHNIKA in Russian  
No 2, Feb 92 pp 24-26

[Article by; I. M. Vershitskiy, V. A. Voyennyy, candidate of technical sciences, A. A. Nikulin, L. A. Safronova, A. I. Chernyak, Engineers, VNIETO; UDC 621.365.22.001.4]

[Abstract] The electrodes holding arms are an important construction element of the electric arc steel melting furnaces. It must be mechanically strong under operating conditions of high static loads, due to the weight of the electrodes and flexible cables; it must withstand shock and electrodynamic loads when high current is applied to the electrodes; and it must be resistant to the thermal loads. An electrode holder was developed by the German company "Fuchs systemtechnik" and modified in the All Union Scientific Research Institute of the Electro-thermal Equipment (VNIETO). The holder's performance was tested with an industrial electrical arc steel melting furnace model DS-6N1. The fundamental technical data of the furnace are listed along with the results of measuring the parameters of the current carrying arm. The new arm of the electrode holder exhibits superior electrical and service characteristic, it is smaller in size than the original and has a better design. The water consumption for cooling the arm can be reduced to a minimum. In operation with the DS-6N1 furnace, the use of the electrical energy was reduced by 187,000 kWh/year. Figures 3, tables 2.

**Theory and Implementation in the Development of Electro-Thermal Equipment for Directed Irradiation**

927K0302F Moscow ELEKTROTEKHNIKA in Russian  
No 2, Feb 92 pp 33-36

[Article by; A. V. Arendarchuk, candidates of technical sciences, VNIETO; UDC 621.36.002.5]

[Abstract] With directed radiation generated by the electro-thermal equipment it is possible: to produce a local thermal zone on the object of heating or in the working area of some technological facility, etc, with minimum thermal losses; to form a thermal field of complex configuration; and to control the irradiation process in time as well as in space. Because of these features, application of the electro-thermal equipment with directed radiation (ETEDR) in medicine is being constantly expanded. Two fundamental development trends are observed: one is in the direction of improving the spatial selectivity of irradiation by controlling the radiation pattern of the sources, and the other is in the direction of increasing the automation level of processes controlling the sources of the directed radiation. Both trends are directed towards a maximum possible adaptation to the features of the treated subject. Methods for a system design of the ETEDR are discussed. Figures 2, references 10 Russian.



**Electromagnetic Compatibility Diagnostics  
Equipment for the Electric Power Supply System**

927K0302G Moscow ELEKTROTEKHNIKA in Russian  
No 2, Feb 92 pp 40-46

[Article by; V. I. Rozenov, candidates of technical sciences, Omsk Polytechnical Institute; UDC 621.311.314.6].013.001.8]]

[Abstract] Experimental study of electromagnetic compatibility of electrical equipment in the industrial power supply systems is a problem of technical diagnostics. The condition of the entire electromagnetically integrated three-phase network and its component elements must be measured to determine the correspondence between the real values of the operational parameters and the specified parameters or standards. The electromagnetic incompatibility may be the reason for non-correspondence. Special instruments are needed for the diagnostics. An instrument package for measurement and computation called "Omsk" was developed in the Tomsk polytechnic Institute. It consists of two parts: a sub-system for collecting the information and a sub-system for controlling and processing the data. The result of the harmonic analysis which is performed by the "Omsk" can be used to compute the fundamental parameters of the quality of the electrical energy. The measurement and computation units of the "Omsk" can perform a harmonic analysis, identification of frequency characteristic of the input impedance, computation of frequency characteristics based on the circuit parameters for comparison with the experimental data, identification of a non-sinusoidal unbalanced mode of operation, etc. The process of experimental diagnostics of the electromagnetic compatibility can be automated. Studies were conducted and technical improvements were made with respect to the electromagnetic compatibility of

electrical equipment in the operating power supply systems of several large industrial plants using the developed instruments. Figures 4, references 15: 9 Russian, 6 Western.

**Real-Time Analysis of the Electrical Equipment  
Operation Under Emergency Conditions**

927K0302H Moscow ELEKTROTEKHNIKA  
in Russian No 2, Feb 92 pp 53-57

[Article by; Yu. Ya. Lyamets, candidate of technical sciences, A. P. Arsenyev, engineer, V. A. Ilin, candidate of technical sciences; UDC 621.316.925:621.372.54:0011.5]

[Abstract] The general approach to the analysis of a transient process consists in its separation into a periodic (fundamental) and an attenuating component and detection of individual spectral components. The algorithm for spectral analysis is based on the concept of difference equation and consists of four stages: the stage of suppression of the periodic component, the critical adjustment of the adaptive filter, determination of the periodic component and determination of the attenuating component. The stage of determining the order and coefficients of the equation, which is interpreted as adjustment of the adaptive non-recursive filter, has the greatest computation difficulties, and the realization of the algorithm in real-time depends on how much this stage can be simplified. A most simple algorithm for spectral analysis of voltages or currents under emergency conditions, including ultimately simplified adjustment of the adaptive filter is described in this paper. The developed algorithm of spectral analysis includes two types of operations: the operation which is carried out at each step, and the operations executed at the final stage after the adjustment of the adaptive filter has been completed. Tables 2, references 5 Russian.

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